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THE MONTH.

TO our telegraphic and telephonic age, the war seems about as slow as that war against Troy, in regard to whose historic reality, Gladstone and Schliemann are reviving the faith of this generation.

In the Asiatic field of operations the Russians are making some progress, but they are not going to merely invest Kars, while they advance upon Erzeroum. They mean to take that fortress before proceeding farther. The Turks made a good stroke by seconding an insurrection of the Moslems in the Caucasus, the Tscherkesses, and the Abkhasians, but both the mountaineers and their Turkish allies met with a prompt and vigorous resistance, terminating in their defeat. It is reported that a good number of Moslems from the Volga provinces serve without scruple in the Russian army in Asia.

The army on the Danube seems to have been detained chiefly by the impossibility of getting across a river swollen by the melting of the snows. That the Czar has come to take his place among them bodes no good for the result of the campaign. Alexander II. is a man of ability, but a hypochondriac of the most pronounced type. He is irresolute, unpractical, and altogether devoid of that executive genius which scorns every obstacle. If John Sobieski were alive,—and the old hero must be stirring in his grave —the Christians would have been in Constantinople before now.

The Turks seem to feel their need of external aid, if the struggle is to be a long one, and to have adopted a very peculiar way of summoning it. For several days the Russian successes in Asia were reported in exaggerated terms, seemingly with a view to alarming England, and bringing her to the rescue. Close as has been the friendship of the two countries, the Turk has not yet learned the character of his English friends. John is in so far a true Moslem that he worships nothing so heartily as success; all Europe must have laughed at this gross misunderstanding of the principles of his Christian civilization.

ROUMANIA has declared her independence of the Turkish Empire, adding another to the sisterhood of free European States. But she does not seem to have been received with open arms, or any other effusion of affection. The country and its people are a sufficiently curious study, and may be said to have been discovered during this war. It is full of the reminiscences of that old Roman Dacia, from which the people have inherited their Romance language and their Romance origin. Isolated to a great extent from the later currents and movements of European history, it seems to have transmitted to modern times at least as much of the life of an old Roman province, as Greece has of the ancient Hellas. But the graft taken from a decayed tree bears in itself the element of decay; and it is chiefly the self-indulgence, the love of luxury, and the vices of the Imperial era of Rome that they have inherited. Their nominal Christianity seems to have served them only as an opiate for the conscience. They have been intellectually, politically, and in every other sense a stagnant people, while they ape Paris fashions, English institutions, and Slave brutality as regards the Jews, with a fine facility. By reason of their situation in the far north and of their relations to Russia, they have suffered less at the hands of the Turk than his other Christian victims, and they have manifested very little interest in the struggles of the Bulgarians and the Servians for their freedom. They excite no sympathy and no hope.

THE violent overthrow of the French Ministry of Jules Simon by President MacMahon, and the transfer of power to a coalition of reactionaries under the lead of the Orleanists, becomes more intelligible but not more excusable as the fuller accounts of what pre-

cedes that event reach us. The struggle between the Ultramontanists and their antagonists of course underlay the whole event The *parti pretre* is everywhere hoping and striving for a new crusade against Italy, with a view to the restoration of the temporal power of the papacy, and like all fanatical and one-idea-ed parties, they look upon every disturbance as the beginning of their victory. Just as some Protestant enthusiasts of the Cumming type are sure that every great event portends the immediate overthrow of the papacy, so the Ultramontanists can read the story of what occurs in Europe only as bearing upon the release of "the Prisoner of the Vatican." With every excitement, they are excited, and a great war seems "the beginning of the end."

Nor are their opponents a bit less fanatical. Dr. Newman says somewhere in his *Apologia*, that there is a sort and degree of wickedness in Catholic countries, of which Protestant countries are incapable. There is certainly a wide-spread hatred of the Catholic church and even of Christianity among the Radical parties of Latin Europe, to which there is no parallel even in Germany. The notion of treating the priests and their followers as entitled to equal rights before the law with other citizens is fast disappearing from the Radical mind, as utterly as it did from that of the French Revolutionists. All the old hatred divided about equally between the monarchy, the aristocracy and the hierarchy, is now concentrated upon the last alone, and the murder of the Archbishop of Paris by the Communists was but the solitary outburst of a dark abyss of unreasoning malice, which underlies half the life of France. It needs but to look at the latest and most popular Parisian prints and engravings, to see how much of fierce sarcasm is aimed at the priesthood, and how rapidly the light, mocking, tolerant, or at least not consciously intolerant spirit of Voltaire is again giving way to the atrabilious, intolerant spirit of Marat. The old type of anti-clerical picture,—the fat abbott detected by the roguish boys and vainly hiding his Friday fowls under the table, and the like,—was consistent with and even implied some degree of contemptuous sympathy with the weakness which was satirized. But nothing short of contemptuous hate is indicated by this new type of picture, of which the best representative is one called "After the Sermon." The priest seems to have just come from the pulpit; he is standing in one of the splendid vestry rooms of the church, holding his sides in convulsions of laughter—laughter whose object must be the audi-

ence he has addressed, the ritual at which he has assisted, the words he has spoken. A more hateful object can hardly be depicted. And this new type of radicalism is that which is spreading through French society—spreading all the faster for the forced hypocrisies which prevailed under that saviour of society whom France so recently lost. M. Gambetta has at last—it is charged—made himself its mouthpiece, and thus arrayed France in two hostile camps before the recent quarrel broke out.

As usual in French politics, the technical wrong is chiefly on one side, but the essential wrong is on both. Both parties put the thing they like before the thing they ought to do; in neither is there that higher devotion to any large common aims whose contemplation would diminish the sharpness of party antagonisms. France by rejecting the Reformation, and failing to achieve any equivalent reconciliation of faith and science, has condemned herself to irreconcilable antagonisms and violent reactions. We do not say that Protestant communities have always realized in actuality any such reconciliation; but they have accepted it in idea, and they have the possibility of it.

The most hopeful sign for the future is found on the Republican side. All the sections of the Left have shown a masterly reserve and self-control under great provocation, whose motive we would fain hope is more directly patriotic than the dread of the President and his soldiers repeating the *coup d' etat* of 1851. Rejecting the Budget, and declaring by an overwhelming majority their want of confidence in the DeBroglie Ministry, they have yet abstained from all extreme measures, nominated M. Thiers as their candidate for the Presidency should MacMahon resign it, and quietly submitted to the exercise of the power of dissolution vested in the President and the Senate.

THE notice given by M. Thiers during his brief Presidency, that the Commercial Treaty of 1860, between France and England, would cease to be of force at a given date, has not been canceled by his successors in power. The French ministry in 1874 sent out notices to all the various Boards of Trade asking their views on the matter, and the majority asked for a revision of the duties. These were referred to the Superior Council of Commerce, which in spite of all the influence brought to bear upon it by the Free Trade and the English interests, recommended that the Protective

system should be adopted in general for the country, and that whatever changes should be made by treaty should be of the nature of reciprocal concessions. In the course of this discussion one point, was brought forward which has been strongly insisted upon by Protectionists, but never before admitted by any of their opponents. "In vain it was shown," says *The Saturday Review*, "that the commercial treaties only exchanged a prohibitive for a protective tariff; that for example iron . . . and yarn, both cotton and woolen . . . are taxed more heavily than in almost any other European country. . . . The Council decided that the tariff of the treaties should be adopted as the general tariff. . . The Government has introduced a bill in accordance with the decisions of the Council. Another decision of great importance was that specific duties should in every case be substituted for *ad valorem*."

Now observe the effect of this preliminary action upon the negotiations. Only a Protectionist country can secure any other terms than those of that Tariff of 1860, which we have always asserted to be protective, and which is now admitted to be so. For only Protectionist countries can make concessions, and thus secure reciprocity. England in 1860 wiped out her last Protective duties on articles whose import concerns France, and she cannot now reimpose them. She has nothing to offer, nothing to expect. She had something to offer in 1860, because for fifteen years after her nominal adoption of Free Trade she went on protecting her silk manufacturers. French competition has now driven them out of their home market. Macclesfield and Coventry were hardly represented at our Centennial Exhibition; they told the British Government very plainly during this present year that without Protection they cannot go on. They were thrown in 1860 as "a tub to the whale;" but there are no more such tubs to throw, unless it be the duty on wines. "But a proposal to reduce the wine duties would raise in arms the landed interest of the United Kingdom, and the whole liquor trade as well. The agitation for the repeal of the malt duties would revive in full force, and the complaint of Ireland that she is overtaxed . . . would gather fresh strength, and would be reinforced by the complaint that she was sacrificed to foreign interests."

And furthermore the substitution of specific for *ad valorem* duties will make the "protective tariff" of 1860 far more protective than it was. Specific duties bear hardest on the coarser and

cheaper varieties of goods. "But the English trade with France in textile fabrics," says our London contemporary, "is almost exclusively on the coarser and cheaper goods. The French manufacturers can more than hold their own in the finer qualities."

We are not surprised to hear that when the French and English Commission to revise the Treaty of 1860 met, they found their task not an easy one. The English had their proposals all neatly ready, as to what France should do:—so much duty to be taken off this now, so much off that, so much more five years hence. But when met by the answer that the French Government had decided to maintain the Tariff of 1860, except as modified by reciprocal concessions, and to convert all duties into specific, they found they could make no headway. They adjourned their sessions, and went home for fresh instructions. On the other hand nearly all the chambers of commerce, on whose support they had relied, have pronounced against their proposals.

On the whole we shall not yet take France out of the list of the countries which owe their prosperity to protection; and a country which can save a quarter of a milliard every year is likely to enjoy economic prestige enough to lead others to follow her example. How the present troubles have affected the pending negotiations, we cannot say. We do know what will be the effect of the triumph of the Republicans, and of the accession to the Presidency of the great Protectionist statesman who is the true choice of the French people; and England knows.

THE Ridsdale judgment, forbidding the use of any vestments in the services of the English Church, which are not used at all times and in all services, has created no little excitement in ecclesiastical circles, and even some signs of organized revolt. The ritualists who protest against the decision, seem to have good ground to complain of the whole relation of the church to the legislation by which she is controlled. There is no "voice of a living church" nor even of a living state to adjust the law to the needs of a new generation. What was enacted in the reign of Elizabeth to revive and legalize the usages of the reign of Edward VI., is the standard by which clergymen of the reign of Victoria must be governed. For the recent legislation on the subject merely provided a tribunal and a method for the prompt punishment of offenders. The need of new adjustments is very evident, but is prevented by

the absence of some adequate representative body to legislate on the subject. Parliament no longer represents the laity of the church; the Convocation represents but a fraction of the clergy; and in the absence of any adequate method of securing a conference of their views, the breach between laity and clergy is rapidly widening. That during the present not very rational excitement against the ritualist party, any extension of liberty as regards the matters now involved in dispute would be granted, is not probable. But if the Ritualists will but adopt the old Tractarian motto: "In patience and quietness shall be your strength," they will see this like other excitements, notably that which culminated in the Ecclesiastical Titles Bill, pass away and be forgotten. We speak not merely from the sympathy engendered by seeing well-meaning people treated with unreasonable harshness, but also from the conviction that the type of thought which they represent, has, while no exclusive claims to men's adherence, yet a great and permanent importance in the development of the Christian church.

THE student of social methods and ideas will not fail to be amused by the curious conflict of feelings with which Gen. Grant's reception in England is regarded by his fellow citizens in America. The instinctive sense of propriety, the growing respect for social forms, and the sense of the General's representative character as standing for the American people, all incline Americans to approve of the action of our government and its English representative in suggesting a distinguished reception, and the cordiality and spontaneity of our English friends in conceding it. But on the other side is the powerful tradition first established by the Jeffersonian Democracy, and now come to be regarded as essential to our national character,—the tradition that "republican simplicity" is not consistent with display and a formal etiquette, and that our public men should imitate the supposed simplicity of Cincinnatus and Cato. Simplicity and the absence of pomp has certainly not been identified in history with republican government. The republics of Greece and Italy affected as much style as any monarchy could, and for the reason that they found it of use. George Eliot in her *Romola* makes Cennini speak of the public processions of Florence as "the great bond of our republic expressing itself in ancient symbols, without which the vulgar would be conscious of nothing beyond their own petty want of back and stomach, and never rise to the

sense of community in religion and law. There has been no great people without processions." The old Federalists were much of that way of thinking, as we learn from the recently published *Recollections of Samuel Breck*, who ascribes the change in this respect to "that leveling philosopher Jefferson" and the slave holding planters who succeeded him in the Presidency, and who managed everything in the slovenly style of their plantations.

But the pseudo-classicism of our "republican simplicity" will not long maintain itself in the face of the revival of the artistic instinct among our people. It will come to be seen that the elective character of our magistracies is no reason for the absence of those outward symbols of dignity and authority, with which other peoples have always sought to invest the representatives of their social unity and political dignity. Even the throne, as the symbol of the permanence of the governmental system, while rulers come and go, is far more fitly the seat of a republican chief magistrate than of the "personal" ruler. The old tradition will remain as an element of wholesome restraint to ensure moderation, but will lose its present normative force.

THE month has been an eventful one, as regards the development of the financial policy of the Administration. Secretary Sherman has the fullest confidence in the wisdom of the Resumption Act, and of his own power to execute it by contracting our paper currency. And he has not been sparing of declarations to that effect, and has pointed out various ways in which he will be able to do what has no direct sanction in the laws of the United States. For instance the currency reserve of the Treasury has been used in canceling the twenty-two millions of greenbacks, replaced by national bank notes under the new banking law. This amount he claims the right to replace by buying up that amount of greenbacks with the gold received for new issues of bonds. Then again, the law providing for a Sinking Fund, though clear enough as to its intent, is so loosely worded that the Fund could be converted into a receptacle for redeemed treasury notes, probably on the principle on which some of our railroad corporations make their Sinking Funds the depository for "pups."

On the other hand, by throwing his new four per cent. bonds in the market, he hopes to secure the control of vast sums of gold, which he is at full liberty to spend either in legitimate funding

operations, or in hoarding gold, or in cramming the Sinking Fund or the Treasury reserve with greenbacks, the two latter operations being meant to facilitate resumption. He stopped the sale of four and a half per cents, when a hundred millions of their amount were still undisposed of, and presented the four per cents to the public for popular subscriptions at par, while money commands eight and nine per cent. on the best security.

At this point a question was raised which brought into the sharpest light the conflicting forces which are brought to bear upon the Treasury. The four per cent. bonds are redeemable in coin "of the standard of 1870," and at that date silver was legal tender, the double standard not having been abolished till 1873. Now four per cent. bonds purchasable at par in gold, but redeemable in silver, are a ridiculous investment to offer in the European money markets, much more in those of America; and a Treasury official at once came forward with the declaration that in spite of the explicit and unmistakable statement on their face, they are redeemable only in gold.

But then came the outcry from the Western Republicans, that Sherman had surrendered them to the Democrats. All parties in the West have seized upon the silver solution of the financial problem, as the best compromise between the hard money and soft money positions, and the coming elections in Ohio or Indiana are expected to depend on the extent to which the party declarations on this subject harmonize with the views of the public. The Administration is anxious for a Republican victory, especially in Ohio, and also for an approval of the President's policy by his home constituency, and was ready to go so far as to approve of a remonetization of silver on the same footing as paper, but not as the equivalent of gold. What value this distinction has in the minds of those who expect to raise paper to a gold value a year hence, it is hard to say. At any rate, they would not be too hard on the argentine Republicans, and the official's letter was quietly snubbed, in compliance, it is believed, with pressure from Ohio.

But now "t'other dear charmer" lifted up her voice in protest. The syndicate could do nothing with the new bonds either at home or abroad, without some security for their redemption in gold. And in view of the very distinct wording on their face, the silence of the Treasury would be fatal. Whether its speech in such a matter is worth much may be doubted, but speak it must. At

whatever political risks, Mr. Sherman, with the support of President and Cabinet, undertook to explain away an enactment of Congress, and to bind the United States to do what the competent authority had made no promise of. Had this question been raised after the sale of the bonds, public faith might have been pleaded for such a construction. And had there been any urgent and immediate necessity for their sale, the nation might have felt itself bound by the act of its official, just as it would by any arrangement he might make at present for the payment of the army. But such conduct, under the present circumstances, shows that Mr. Sherman and his colleagues have some very peculiar notions as to the extent of the executive authority; and if the bond-buyers are simple enough to suppose that Secretary Sherman's letter is worth more than the paper and ink expended in its production, they are more innocent than they are generally thought.

The national banks and the banking firms are rapidly dividing into two parties on the resumption question. On the one side are the syndicate and its friends, who are at present the controlling force, as they have the Treasury at their service. On the other, are nearly all the rest of the banking interest, including multitudes who were formerly zealous for resumption. The national banks in particular are beginning to count the costs of a forced resumption, and many of them have threatened the Treasury with a wholesale cancellation of their issues if they are to be required to redeem them in gold, while that metal is so scarce and costly.

THE country has lost nearly at the same time its best and its worst historian. Mr. John Lothrop Motley, historian of William the Silent, and Mr. John S. C. Abbott, the eulogist of Napoleon the Little, have died within a month of each other.

Mr. Motley was descended from one of that little group of Scotch-Irish settlers in Northern New England, to which we also owe Greeley and the Websters. His first venture in literature was as a novelist, and happily failing in that he devoted himself to historical study. He showed great judgment in the selection of his theme, as there is hardly any subject in modern European history more provocative of enthusiasm, or more happily central to the European history of the time, than the creation of the Dutch nation by the Calvinistic Reformation. The merits of his books at once commanded European recognition, and brought him the gratitude of the Dutch

people. It was seen that he had so much surpassed Leo and other modern historians of those events, as they had the older writers Strada and Brandt. His last work on Dutch history, John de Barneveld, has not met with such universal favor in Holland, because it gave great offence to the conservative party, and Groen van Prinsterer has shown that Mr. Motley is not always happy in his grouping of facts.

His career as a diplomatist at Vienna and London was honorable to himself, but its termination not so to two Presidents of the United States.

THE Temperance Reformation which is now spreading in this and in other cities, would excite more hopefulness if we had not had repeated experience of the inadequacy of its method to effect any thorough and extensive cure of the evil. To reach individual drunkards, to secure from them a pledge of total abstinence, and to throw around them the sympathetic influence which will hold them in the right way, is well and good so far as it goes. And it must be said that Mr. Murphy and his friends are working on a higher plane than most of the Temperance Reformers. Himself formerly a dealer in liquors as well as a drunkard, he has written "With Malice toward none, with Charity for all" at the top of the pledge, and his exhortations are quite free from that acrid and passionate pharisaism, with which the very name of Temperance seemed likely to become identified. Nor would we at all depreciate the value of his results. We have high authority for believing that the repentance and amendment of "one sinner" occasions in very high quarters a sensation not justified by the science of statistics and the "law of average."

And yet prevention is needed as well as cure; and to a very great extent the power to prevent this evil rests with society and nowhere else. We should not go on by our neglect of precautions creating drunkards for Mr. Murphy and Murphies as yet unborn to cure by their efforts. The friends of the new movement repudiate, as a rule, all dependence upon political measures, therein separating themselves from the older Temperance Associations who desire the legal prohibition of "the traffic." But the Prohibitionists are quite right in maintaining that social and political action is needed to effect a true reform in this matter. They were only wrong as to the sort of action that was needed, and were led

into that error by the extremeness of their views on the main question. Those who hold that alcohol is a poison, and its use a sin, could not be expected to reach any moderate conclusions on the subject of the State's action; and they have failed, because those two propositions never have been and never can become integral parts of a permanent public opinion. And therefore a law which is based upon them will always have the appearance of a meddlesome interference with individual liberty, and the popular sympathy will go with the lawbreaker rather than with the law.

The temperance reform must now take a shape which will carry public opinion with it, and thus secure an effective regulation of the traffic. It must reduce the number of establishments engaged in the traffic within reasonable limits, and exact precautions for its orderliness. It must raise the payment for licenses to such a figure that those who buy them will dread the forfeiture of a license as a heavy pecuniary loss, and will find it to their interest to put down all unlicensed trading, such as is carried on in two hundred and twenty taverns and saloons of our own city. It must prevent the adulteration of the liquors sold by a careful scientific inspection, so that poor alcohol shall no longer be burdened with the offence against health and sanity committed by a thousand noxious poisons.

THE recent successes accompanying the efforts to bring American manufactured goods to the attention of foreign purchasers, has raised the question of establishing direct and extensive commercial relations with those countries, with whom we now deal but sparingly and through the medium of England. The manufacturers of Great Britain enjoy very exceptional facilities for reaching every market of the old world, because of the lines of steamers which connect her ports with nearly every commercial emporium. These lines were very largely called into existence by government patronage and subsidies. That form of "taxing the people at large for the benefit of a few producers" has never been found inconsistent with the English theory of free trade. And our own country can with far more consistency take the same step in the promotion of our own commercial interests. The Centennial Exhibition made a good beginning. Already, in consequence of it, our agricultural machinery and implements have supplanted those of England in Russia; American locomotives are going to Eng-

land and to Australia; American watches are superseding those of Switzerland on the Continent of Europe; exports of glass, cotton and paper are making to England itself. But a battle is chiefly utilized by the vigor with which the victory is followed up; and our Exhibition should not prove a Gettysburg through our remissness. We need a more direct and satisfactory communication, first of all, with the people of South America. By all the peculiarities of their situation, they are our natural customers; and if commerce is equal to any of the grand things claimed for it, we may thereby do some incidental good to the political life of our sister republics. Next we need more direct trade with the great silver consuming nations of the East *i. e.* with all the people of Asia and Africa. The bad management of East Indian finance has practically and finally closed the avenue through which our surplus of silver once found its way to them through London. We must now open a new channel of our own. In every quarter of these hemispheres, they need the goods which we are fully able to supply them, and what they do sell us, we now import through London. Mocha coffee, spices, tapioca, and a thousand other commodities reach us after paying half a dozen profits on their way through London and Liverpool, while a direct trade with these countries would be more advantageous and fairer to both parties.

The plan of the new administration to make our consular service a world-wide agency for the collection of useful information on commercial topics, is eminently timely. The English Consuls have been engaged in that service for a long period, and every opening for the extension of English trade has been carefully watched and utilized. And the day may even come when the commercial class will take a pride in the extension of our national interests, and thus rise from being mere "importers," into the higher position of the true merchant.

We cannot entirely sympathize with the principles upon which the Administration is carrying out the Civil Service Reform. We see in its action and its plans, no assurance of any permanence of result. We feel that it is sometimes attacking not the root but the branches of the mischief, as in forbidding its officials to take a prominent part in political management. Nor can we understand why such men as the Collectors of New York and Boston are suffered to

retain their position. But the Administration errs chiefly by defect of action: when it does act, it generally acts rightly, as for instance in announcing that the branches of the public service must be managed on the same business principles as a wise and thrifty merchant would adopt in the management of his private affairs.

Of all the appointments made thus far, the selection of James Russell Lowell as Minister to Spain is that which commands the most general approval. Had the destination been London, it would have been even better. Still it will be a good thing for our poet to have seen a country worse than his own, while quite free from the vices which in his despondent moods he seems to regard as the certain augury of our destruction. For the "statesmen" of Spain do not steal; hence the promptness,—caused by pure indignation and utter want of sympathy,—with which they voluntarily sent Tweed back to us. And no doubt our literature will be a gainer from Mr. Lowell's residence in that illustrious land. Cervantes, Calderon, Mariana, Theresa—and who can say how many more—may be revealed to us through our poet's mission to the land they loved, and become "familiar in our mouths as household words."

HOW TO ELECT THE PRESIDENT.

PLANS for election of President are now in order, and people are in a frame of mind to consider them; as, realizing the great danger through which they have just passed, all admit that something must be done. Knowing the perils we have escaped, it is criminal to risk them again. "The Constitution as it is" will no longer do, and already several well matured plans for its amendment have been presented, all of which propose a new mode of electing the President, while Mr. Charles O'Conor suggests a still more radical change that would do away with the office of President altogether. He would also have but one legislative body, from which the Chief Magistrate should be elected by lot every month, so that the Executive could have no policy and no duties except to enforce the decrees of the Legislative Chamber. Such a

government as the great lawyer proposes might prove the best ever devised by man, but as it is not possible that it will be adopted till something less innovating has first been tried, we may glance at the other plans which have been proposed, and then consider whether there is not yet "a more excellent way."

The plan of Senator Morton is perhaps the most likely of all to receive the popular support, for the reason that it does not so much disturb the present routine of elections as do the others, and keeps up the illusion of an electoral college after it has ceased to exist. The people under this plan are to vote directly for President and Vice-President, and in each state the candidates having the highest number of votes would be entitled to the two electoral votes at large, while in each congressional district the persons having the largest number of votes would receive the electoral vote of that district. There would be no electors chosen, yet the states would have the same relative strength in making the choice as under the present mode.

The Maish or Buckalew plan also provides that the people shall vote directly for President; that the states shall have the same number of votes respectively in the electoral count that they now have, but that they shall be divided between the parties proportionally, according to the number of votes cast for the different candidates.

Another plan, not new, has recently been revived and approved in high quarters, called the Hillhouse or Nicholas plan. This is thus described: "The electors are to be chosen for each million of inhabitants, and they are to be divided alphabetically into six classes, * * * the members of each class to choose one elector from the class next succeeding it, except class six, which is to choose from class one. * * * Each class is to select one member from the class next in order. From the members so selected two are to be designated by lot, and from the two so designated the President is to be elected by the whole body of electors; and the one not elected President is to be Vice-President." Each state having less than a million inhabitants is to have one elector, and those states having over one and less than two millions, are to have two electors, and for each million above that a state is to have an additional vote.

This plan, which seems to be the one most favored by the editor of *Harper's Weekly*, has the merit that under it an election could

have but very little of a partisan character; and it would to a great extent meet the objections of Mr. Charles O'Conor to the present mode of electing President, as the uncertainty of the result would be such as to deter any leading presidential aspirant, his friends or followers, from making any very strong efforts to secure him a place among the electors, as, if successful in this, the chance of winning the first prize would still be very remote. Yet this chance, while it might and probably would incite "the paltry little wrens of faction" to strive for a place on the electoral ticket, would not be sufficient to induce "the lordly eagles of the land" to stoop from their flight to obtain it. Hence, while by the Nicholas plan it would be by the merest chance or accident that a leading statesman would ever be chosen President, it would not give the advantages of Mr. O'Conor's plan, which depends on "the brevity of the term to prevent serious mischiefs from incompetency." Under both systems there would be the danger of having an incompetent at the head of the government. In the one case it would be only for a month without hope of change; in the other it would be for four years.

Apart from the other objections to both of these plans, the fact that the element of chance enters into them probably would, and certainly ought, to prevent their adoption. Under the Nicholas scheme, the electoral college in 1880 would contain about sixty electors. These being divided into six classes, each class would choose from another class, in round-robin fashion, one elector who should have a chance to "shake" for the presidential prize. From the six thus chosen, two would be selected by lot for President and Vice-President, and then the whole college decide by vote which should have the first prize, while the other would be the Vice-President. The successful candidate in this case might, by a possibility, be the fittest man for President of the whole body of electors, and, indeed, the fittest of the whole country. And so might the tallest or the shortest, or the one having the most clearly defined strawberry mark on his left arm. But the chances are he would be a very ordinary and very respectable man, who would have more reason to be thankful for his good luck than for his eminent ability.

The chief merit of this plan is that under it a presidential election would be a very tame affair; that its occurrence would hardly cause a ripple in the current of business, or an anxious thought in

the public mind. These are important objects, scarcely less important than the avoiding the dangers of a doubtful election, such as we have just escaped. All admit that something more is necessary than to secure an honest and satisfactory counting of the votes; that something should be devised to save the people from the excitement, the intense partisan feeling, the enormous expense, the suspension and derangement of business, to which the country is now subjected every four years. All agree that the object to be had in view in adopting a new plan is to get the best possible President with the least possible disturbance. In the uncertainties of the future, no one can count on gaining personal or party advantage by any new plan; and hence, under the commmon instinct for fair play, all ask only for what is safest and fairest. It is not therefore only to provide a mode for the election of President which shall give a true expression of the popular choice, but to avert the violent party contests which are so damaging and discreditable to the country, that is to be considered in the proposed change in the Constitution. The intense partisanship engendered under the existing system is not only calculated to drive the best and ablest men from political life, but to leave the field to demagogues who depend on party zeal to give them prominence and power. An end of all this artificial patriotism that is stimulated by selfishness, is what the people generally desire; and the proper time to accomplish it is now, while the dangers just passed are fresh in the minds of the people, and their attention is directed towards a remedy.

The periodical tumults that have been incident to all presidential elections for the last forty years, have been the wonder of foreign observers. How a people could pass through them so many times and yet accept the results without civil war, has astonished the rest of the world. That it cannot always be so is as certain as that the pitcher carried too often to the fountain will be broken at last. This ever-recurring danger, with its accompanying financial and industrial derangements, is often cited by political economists as an argument against republican government; as if it were impossible to choose a chief magistrate at regular stated periods, without a repetition of the same scandals, the same excitement, and the same costs, both in time and money. They allege that though hereditary sovereigns may sometimes prove weak, dissolute and wicked, yet it is safer to tolerate them rather than trust to the

popular choice; that though it might reasonably be expected of an intelligent people that they would elect one of their ablest and most eminent men as their chief magistrate—one far superior to the average of royal princes—yet experience has shown that remarkable abilities are rather a hindrance than a help to this preferment; that it is very long since any man has been elected President, who had, previous to his election, been conspicuous as a statesman, or had shown any peculiar fitness for the office; and that, therefore, it is safer to risk the imbecilities of monarchy rather than trust to the frenzy of popular elections.

Now it would seem that in a nation like this, made up of many states, each sovereign within certain prescribed limits, a way out of this difficulty might be found so that the people of each State might be represented in making choice of a President, and in a manner which would be unattended with partisan excitement or popular tumult. It would seem to be a very simple thing to do, if people could only divest themselves of the idea that there is something so grand and mysterious in statesmanship, that simplicity and common sense, such as are essential to success in business affairs, are quite out of place in the administration of government. A sensibly managed business corporation, in entering on any important undertaking, would pay little regard to tradition or "the wisdom of our ancestors," but would look directly to results, to obtain which they would seek for that practical knowledge possessed by men of experience in different departments. If they were to build a railroad, or a factory to be run by water power, they would first get the advice of the best civil engineers; if they were to start a line of steamers, they would before building them consult those who had made it a life business to build steamers, and knew what would be the most profitable style of vessels. If an observatory were to be built, the mathematician and the telescope makers would be applied to. To choose a President, the framers of the Constitution went to work on business principles. In fact, that wonderful instrument of human wisdom was the work of men who revolutionized the science of government, by improvising what the exigencies of the country required. They realized as by prophetic inspiration that a direct vote of the people was liable to give the results which have been experienced; that the ablest and best men would be pushed aside for available mediocrity, and that it would be safer to trust the election to a college of electors,

chosen expressly to elect on their own judgment and responsibility the man best qualified for the high and honorable position. The intention was that the electors should choose the President, and not merely pass forward the votes already cast by the people. Having been entrusted with what was intended to be an office of high honor and responsibility, it was taken for granted they would exercise their best discretion, and choose one of the most eminent statesmen in the country. But party spirit ere long became so rife that the purpose of the plan was entirely subverted, and electors were nominated and elected to do a specific thing: that is, to vote for a particular man. Thus the system was soon seen to be a failure, though it has been tolerated till it has come near to involving the country in general disaster; and now it is universally admitted it must be changed.

That the plan of those who formed the Constitution may be carried out, it is necessary that a new mode of choosing the electors should be substituted for the one that has been found to work so differently from what was expected of it. The electors should be men who are not nominated or elected for the single object of voting for a particular candidate; but who have previously filled the highest positions in their respective states. If, for instance, the law provided that the electoral college should consist of one elector from each state, and this elector should be the chief justice of that state, or the judge in the highest court who had been longest on the bench; no one can doubt but that such a body would elect one of the very ablest and most eminent statesmen in the whole country. It might be objected that such a body would be too conservative, and would be too prone to prefer a man eminent for legal knowledge and attached to the traditions of the past, to one distinguished for executive ability and in full sympathy with the spirit and progress of the times. Again, if this body of electors were to consist of the heads of the highest educational institutions in each of the different states, it is equally certain that the choice would fall on a man of great eminence and great learning. But as the members would be nearly all clergymen, the danger is that they would be influenced by a sectarian spirit, to the disregard of those worldly interests which Presidents are chosen to guard and protect. A proposition of this kind, it is quite sure, would never be entertained by the people; and, therefore, it is not necessary to consider it.

Now if there can be found, in each state, one or more individuals

who is a representative man and proved to be such by the popular indorsement, in having been elected and re-elected to the highest office of the state by the direct vote of the people, and who is retired from public life, certainly it would seem that to a body composed of such men might safely be entrusted the choice of the President. Let us suppose then an amendment to the Constitution to be adopted, to take the place of "Article XII.", providing for an electoral college, to be composed of men who have not only received such indorsements, but who are and must be men of large political experience. Let the elector for each state be that citizen who has served for the longest period as governor of his state, and who has not held the office for the last two years preceding the time when he may be called upon to act as elector. This would give us an electoral college composed of men of distinction in their respective states, if not of eminence throughout the country; of representative men who had received the highest proofs of respect and confidence from their people, and that, too, when the honors given had little reference to presidential aspirants. As a security against improper influences, it might be well to provide that not only should no elector be eligible to the Presidency, but no one should receive any federal appointment during the term next succeeding. Should any ex-governor decline to act as elector on such conditions, he might do so, and relieve himself of the disabilities by resigning at a period of six months or a year preceding the assembling of the electoral college.

The electoral college being thus constituted, the members of it would have that responsibility thrown upon them which it was expected they would have when the present method was adopted. It is not an innovation in spirit or principle; it is a new way to do what the Constitution, as made by its framers, was intended to do, but for which the adequate means were not provided.

The electors being created in this way, there would, of course, be no such thing known as a presidential campaign. The interest felt in the future policy of the government would be directed to the election of members of Congress and of Senators through State legislatures. Long before the time for casting the votes for President it would be known who the most of the electors would be, and there would be no occasion for ambitious aspirants to make combinations, to pack conventions, to forelay for delegates, to trade off votes for promised cabinet seats, or foreign missions, or for in-

fluence in making senators. All these evils, great and trying as they are, and inseparably interwoven with our present system, would be done away with. There would be no more partisan campaigns as we have known them in the past, making heroes of demagogues, and arousing the worst passions of the people to their own impoverishment and disquiet; no eager anxiety as to the result; for though there would be great uncertainty as to who would be chosen, yet it cannot be doubted there would be full confidence throughout the country, that such a body as would make up the electoral college would never elect an untried, an obscure, or an unsafe man. Their own self-respect would prevent them from preferring mediocrity to acknowledged ability. Instead of having the press and the party leaders engaged in arousing partisan feeling and marshaling the people to stand by old issues and party lines, the public attention would be directed to the measures and policy of government, as represented and advocated by the most able and advanced statesmen of the country. Such men would naturally come to the front, and such a moral pressure would be brought to bear that when the electors should come together it is very certain that the number of those who would be reckoned as even possible candidates would be very small. Before the meeting of the electors, what with the thorough discussion in the press, the pronounced opinions of leading writers and speakers, the scrutiny of acts and character, the public sentiment might be relied on to limit the choice to one of less than half a dozen of the very first men in the country.

The whole responsibility of the election being thrown on a small number of men of established character, they could not do otherwise than try to make a choice that would be creditable to themselves. Responsibility compels self-respect. It is found as a rule it is safer to give the appointment of judges to the governor than to trust their election to the people. A governor may be a weak man, or a violent partisan; but he is sure to be much above the average of the voters; and the responsibility of his position, his pride and self-respect, would cause him to select a competent lawyer, while the people vote for the party candidates, even though they be but pot-house politicians and nominated in defiance of the best men of all parties. Dividing responsibility is very apt to produce inferior work, as a multitude will often assent to what each individual would be ashamed to do. A crowd will flee before

a single armed man, each encouraging the others by his example to get out of danger. Yet in the same crowd might be a dozen or a hundred who, had either of them met the bully alone, would have knocked him down and disarmed him. So in a popular election in time of high political excitement, the most conservative people vote for the party candidates whom few of them would ever appoint, had they the appointing power and its attendant responsibility.

Now, while it is almost as hard to tell what would have happened under other circumstances in the past as it is to predict the future, it can hardly be doubted that had our Presidents heretofore been elected in the way here suggested, the weakest Presidents we have had, as well as the weakest party candidates who failed of an election, would never have been heard of in connection with the office. Instead of such it may be presumed the list of our Presidents would have been made up of the names of the really great men whom the country has produced, and the honor of the office would now be a very different thing from what it is, since it has been filled by some of its later incumbents.

In the times before the civil war, while slavery was the great issue that arrayed the North and South in opposition to each other, such a change as is here proposed could hardly have been considered on its merits, as it would have been favored or opposed according as it bore on that great question. But that source of sectional jealousy being removed, it is scarcely possible that the people will ever array themselves again face to face on a single issue. In a country so vast as this, made up of states having such a variety of interests, in which Texas and Maine, and Oregon and Florida, may be especially benefited by the same line of policy, any danger that the country may be again divided on sectional questions is purely imaginary. It cannot be; and, therefore, it is scarcely possible that the people of any section will ever be united in support of any candidate because of any expected local advantage to be gained by his election. What they will look for in a President is broad, national, comprehensive statesmanship; and with an electoral college created as this would be, all the miserable party feeling, which has in late years so disturbed the social, political, and business harmony of the country, will be a thing of the past, and the constitution will be safe beyond the worst breakers that lay in its way.

An argument that may be made against this plan, and which at first glance might appear to be a serious objection, is that the small states would have an equal representation in the electoral college with the large ones. This, if rightly considered, is no objection at all. There is no reason to suppose that an ex-governor of Delaware —a state now entitled to only three electoral votes—would not be as competent, as impartial, as free from local prejudice when called to vote for President, as would the ex-governor of Pennsylvania, that now casts twenty-nine votes in the electoral college. There can be no reason in the world why he should not be moved by an equally liberal and patriotic desire to cast his vote for the best man, as if he had been governor of the most populous state in the Union. Locality should have nothing to do with the selection, nor would it have under the plan here proposed. On the other hand it has, under the present system, a great deal to do with it; and so very likely it would have under the Morton, the Buckalew, or the Nicholas plan. The leader of a state organization, by the skillful use of party machinery, frequently has his state delegation united in his support at a nominating convention. If he be from a great state like New York or Pennsylvania, this united delegation may make him a prominent candidate, who may perhaps be nominated, and if not he may dictate the terms on which a competitor may succeed.

In the late Convention at Cincinnati, the Governor of Pennsylvania was regarded as a possible if not probable nominee, solely because the delegation from his state was instructed to support him. Had the same gallant soldier and excellent Governor hailed from a small state like New Hampshire or Arkansas, and been backed by the united vote of his state, the fact of his having the delegation instructed for him would hardly have caused his name to be mentioned in the list of candidates. And so with the eloquent senator from New York: having nearly thirty votes from his own state, he was a power in the Convention. So it was with the other prominent candidates. Each one started in with a delegation from his own state, in most cases, unanimous in his favor; and what the result would be soon became a question of sharp practice, of lobbying, of promising, of trading and endurance. Fitness and character were no longer thought of, and even availability was but lightly considered in the turmoil that followed the assembling of the convention. It is true that the outcome was better than could reasonably have been expected; but are we always to trust

to the chance of a wild scramble in which passion and noise preclude the possibility of wisdom and deliberation?

But the objection that the smaller states would have an undue influence, and out of proportion to their population, may be obviated under this plan so effectually as entirely to remove it. Though the number composing the electoral college should still be one from each state, yet the electoral votes need not necessarily be restricted to the same number. The elector of a state having a population of 500,000 might be entitled to one vote in the college, the elector of each state having over 500,000, and less than 2,000,000, might have two votes, and those from states having over 2,000,000, three votes. This would probably work better in practice than having more than one elector from a state, as in the latter case they might neutralize each other, and so the larger states have less influence in the result than the smaller ones.

But whether each state be allowed one vote in the electoral college, or more according to the population, the popular wish, the general sense of the people can hardly be so little regarded as it now is, when our national conventions are composed of politicians, the most of whom have been elected because of their devotion to the fortunes of certain Presidential aspirants, and when he is most likely to have the greatest positive strength among these picked and packed men who has done the most disreputable work in manipulating party machinery.

As a rule, the people only want the best man for President, and do not care a straw from what state he comes. Yet under the present system, the candidate from a large state, if backed by his delegation, enters the convention with a great advantage over another with ten times his ability from a small state. As nominations are now made, what chance has a state like New Hampshire, with only five votes in the convention, even though she have a statesman like Webster to present as a candidate, against a state with twenty-five or thirty votes, and no statesman at all, but only a party manager; and what claims could Delaware, with her three votes, present in behalf of Bayard, as against Tilden, backed up by the thirty-five votes of New York?

That an idea may be formed of how a plan of election, such as is here suggested, would work, let us suppose that a President is to be elected in this way one year from next December; that the ex-governor of each state, who had served as governor for the

longest consecutive period, and whose term had expired previous to December, 1876, should, by the organic law, be constituted a member of the electoral college, and that then this body should proceed to the duty of electing a President and Vice-President. The first matter that would engage public attention would be the political antecedents and present party affiliations of the men who were to be electors. It would soon be known how many were pronounced and declared Republicans, and how many were Democrats; how many who had once been Democrats were now Republicans; what were the peculiar views of all of them on the important living issues before the country; how many were inclined to be Liberal Republicans, and how many Protectionist Democrats; how many were for hard money, and how many for inflation. It is very certain that this inquiry would show such a variety of opinions and principles to be held by them as to render the election of any man on mere partisan grounds at least quite improbable. Presumably they would many, if not the most of them, be men of loose party ties, whose career as ambitious party leaders would be finished, and which they would all be glad to crown with an act creditable to themselves and creditable to the country.

The merits and qualifications of the different statesmen would next be most thoroughly reviewed and discussed; and though many names would doubtless be suggested, it may be presumed that before the day of election the lighter ones would be winnowed out by the breath of popular expression, and only a few of the very first men in the country would remain as formidable candidates. The earnest men of all parties, and all who had deep convictions as to government policy, would labor to create a public pressure to influence the electors already designated; not by partisan appeals, but by setting forth the superior qualifications, the patriotism and integrity of their ablest representative men; and in the open sea of public sentiment the larger craft, from their inherent moral and intellectual weight, would gravitate to the inner circle to the exclusion of those smart party managers whose strength consisted in their liberality of promises and their ability to pack conventions. The debasing doctrine of availibility would never be heard of again, nor would the country ever again be astonished to find unknown men nominated, who had been put forward because nothing but their insignificance could be alleged against them.

Were a plan like this here sketched adopted, it may safely be assumed that civil service reform, thorough and complete, would inevitably follow, and there would be no good reason for making the presidential term longer than it now is, as the evils incident to a general campaign could never occur again.

CHARLES A. WASHBURN.

AMENDMENT PROPOSED IN PLACE OF "ARTICLE XII."

Each state shall be entitled to one elector, and he shall be that citizen of the state who has been elected to and filled the office of governor for the longest consecutive period, not counting the two years next preceding the day fixed by law for casting the votes for President and Vice-President; and in case there shall be two or more citizens of the same state who have served as governor for an equal length of time, then the oldest in years shall be the elector. But no member of the college of electors shall be elected President or Vice-President, nor shall a resignation as elector remove this disability unless it shall be filed with the Vice-President at least one year before the day fixed for the meeting of the electors. In case the elector of any State shall, for any reason, fail to attend the meeting for the election of President and Vice-President, the ex-governor next eligible to the office of elector shall be entitled to cast the votes of that state. But no person holding an office of trust or profit under the United States shall be an elector. The electors shall meet in the national capitol in the month of November next preceding the commencement of every Presidential term, and a majority of two-thirds shall constitute a quorum. They shall vote *viva voce* for President, and the person receiving a majority of all the votes cast shall be the President, and if no person shall have such majority, then a second vote shall be taken, but no votes shall be counted for any person who was not voted for at the first vote; and after two votes have been taken, if no choice has been made, the person having the smallest number of votes on each succeeding vote shall be no longer eligible to an election. After the election of President, the Vice-President shall be elected in the same manner.

No person holding the office of President shall be eligible to an election for the next succeeding term.

THERMAL SPRINGS AND GEYSERS.

THERMAL SPRINGS are those whose mean annual temperature exceeds that of the locality in which they are found.

Springs, the temperature of which does not vary from 85° F., may therefore be included under that head. Bischof, indeed, asserts that all springs which have a constant temperature are somewhat warmer than the climatic temperature, and consequently are thermal springs.

They may, and usually do, contain mineral ingredients, and may be classified like other mineral springs, still the proportion is generally smaller than in cold springs.

They are distributed all over the globe, but it is in regions of volcanic rocks where there are volcanoes, active or extinct, that they are found in their greatest development. There is not a known volcanic region that has not its accompanying hot springs. They are found in Iceland; in Java; on the slopes of Vesuvius; in Mexico; in Asia; in South America; and lastly, but by no means least, in our own Rocky Mountains.

The intimate connection of hot springs with volcanic action has been repeatedly noticed. Three examples will suffice to illustrate it. Strabo tells us that the sulphur springs in the island of Euboea, after an earthquake, disappeared for several days and subsequently reappeared at several points. At the time of the great earthquake in 1755, the Carlsbad springs ceased flowing for three days.

In Mexico, in the year 1759, the volcano of Jorullo was suddenly upheaved, and caused the disappearance of two rivers, which were engulfed. In their place appeared several warm springs.

This gives a clue as to the source of the heat of the springs. They are generally found in fissures in igneous rocks, or near the line of junction of sedimentary rocks with those of igneous origin.

The water sinking into the fissures becomes heated by contact with the rocks in the depths below. The nearer the heated rocks are to the surface the less is the amount of heat lost by the water in the passage upward. It is well known that as we descend beneath the surface of the earth the heat increases regularly, and the existence of an internal incandescent centre or layer is generally conceded.

It was at one time held that the heat was due to chemical combinations between the various constituents of the earth. Bischof shows the fallacy of this in his treatise on the Internal Heat of the Globe. Sir Humphrey Davy at one time held the chemical theory, but after mature deliberation and investigation abandoned it in favor of the mechanical.

In the Greek Anthology is a poem on the Pythian Hot Baths, by Paulus Silentiarius, Chief Silence Keeper to the Emperor Justinian, in which he speculates as to the cause of the heat of springs as follows: "It is conceived by some that there are narrow fissures below the earth; that opposing currents meeting from various quarters are compressed, and by that compression acquire no ordinary heat. Others on the contrary, say, that in recesses of the earth there are somewhere sulphureous ores, that the neighboring stream, therefore, meeting with a violent heat, from the inability to remain below, rushes upwards in a mass. Which opinion will my readers adopt? The former? I do not myself embrace this. I agree with the latter, for there is a mephitic offensive stench clearly proving it." "'Twas thus the hot bubbling fluid issued for the benefit of mankind,an inanimate Hippocrates, a Galen untaught by art." The phrase "hot bubbling fluid" refers to the bubbles of sulphuretted hydrogen, as is evident from his description of the odor. This was written probably about the year 550 A. D., and it is remarkable that modern travelers, Browne, at the close of the last century, and Hamilton, in 1836, have described this very spring, and from their accounts it is evidently still the same, giving off the same sulphurous gas.

Sophocles refers to the evolution of gaseous bubbles from the hot springs at the foot of Mt. Œta, in Thessaly (from which springs the celebrated pass of Thermopylae is named), and makes a poetical use of it in the play of the "Trachiniae."

Dr. Clarke, in his travels in Greece, found the same springs still giving off sulphuretted hydrogen.

These facts attest the permanency of thermal springs. The temperatures may also remain the same for long periods. In the report of Fremont's explorations, the temperature of a spring on Bear River, in Idaho (then Utah) territory, is recorded as 85° F. In 1871, after an interval of over 25 years, I found the temperature still 85° F.

The pages of ancient Latin and Greek writers contain frequent

references to springs both mineral and thermal. The ancient Athenians resorted in summer to the thermal sulphur baths of Ædipsus, sixty miles from Athens. Herodotus tells us of an intermittent spring near the Temple of Jupiter Ammon, and Pliny in his Natural History mentions cold and hot springs, springing "wholesome from the earth on every side and in a thousand lands." In the Scriptures (Genesis, chap. xiv. v. 10,) the following passage appears, "And the vale of Siddim was full of slime pits." It is said the latter part of this ought to be translated "full of *fountains of bitumen*." Mr. Henderson in his "Travels in Iceland" says that the word Siddim is derived from a Hebrew root meaning "to gush out," which is the meaning of the word *geyser*. In Iceland is a valley called Geysadal, meaning the valley of geysers, consequently corresponding with the valley of Siddim. He thinks, therefore, that the latter should be translated "the valley of gushing fountains;" and is of the opinion that phenomena similar to those of Iceland took place in this locality.

Volcanic phenomena of all kinds are terrifying and well calculated to impress the human mind; and it is not to be wondered at, that the appearance of fountains of hot water gushing from the earth, and streams of gas which when lighted, burned without intermission, should inspire a superstitious people with feelings of veneration and afford them objects of worship. Hence we find they were so regarded among the ancients, and temples were erected near the sites of springs; as for instance at Delphi, the temples of Æsculapius in Greece, and the temple of Jupiter Ammon in Egypt.

The "Spontaneous fires issuing from the peaks of Parnassus," were doubtless streams of lighted gas coming from the earth.

At Baku and other places near the Caspian sea, jets of gas springing from the earth were regarded with veneration by the fire-worshipers. Volcanic phenomena are still occurring in that country and in January, 1872, the town of Schemacha, on the road between Tiflis and Baku, was destroyed by an earthquake.

Henderson thinks that "Sheddim," the object of idolatrous worship on the part of the Israelites, translated "Devils," (Deuter. xxxii. 17; Psalm cvi. 37,) were really boiling springs derived from volcanoes; and Danberry adds in corroboration that similar phenomena at the Lacus Palicorum, in Sicily were the objects, among Greeks, of a peculiar and equally sanguinary superstition. In regard to this locality he says "The singular qualities possessed by

the exhalations given out from this spot, rendered it at a very early period, an object of peculiar veneration, and we may perhaps recognize in the fable attached to it some traces of its volcanic origin. It was called the Fons or Stagnum Palicorum, from two sons of Jupiter by the Nymph Thalia, the daughter of Vulcan, who was concealed by the god from the vengeance of Juno by being buried under ground, so that when the time of her delivery was come, the earth opened and brought into the world her two children, hence called Palici, because they returned into the world after being buried under it. This fable may perhaps allude to the first origin of the gaseous emanations from two apertures; whilst the worship paid to these deities, the human sacrifices at first offered up, the temple built on the spot, and the oracle that was consulted in the sanctuary, show the fear that had been inspired by the noxious qualities of the vapor exhaled."

Strabo says that the springs of Hierapolis imparted a red quality to the roots of trees and shrubs, and the juices of the latter mixed with the water produced a purple dye.

Not only did the ancients ascribe supernatural properties to the waters of thermal springs and erect temples near them, but they also made them the sites of medical schools, hospitals, baths, and resorts for the amusement of the sick. Their curative effects were widely celebrated.

Philostratus says that the Greek soldiers wounded in the battle on the Caicus were healed by the waters of Agamemnon's spring, near Smyrna. The wife of Constantine, in 797, and still later the Sultan Soleiman, are said to have been restored to health by the thermal waters of *Broosa* or *Prusia* in Asia Minor. Yalova, also in Asia Minor, was formerly called Helenapolis after Constantine's mother, the Empress Helena, who was restored to health by its thermal springs.

Herod is said by Josephus to have sought relief from his terrible disease in the thermal springs of Callirrhoë.

The springs of Tiberias were used by the Romans, and with those of Ischia, still maintain their reputation.

The most celebrated bathing place of the Roman Empire was the hot sulphur springs of Baiæ, on the gulf of Naples.

In their conquest of Northern and Western Europe, the Romans sought out the springs of the country, and in Acqui, Aix or Aachen, Dax, etc., the names of modern towns derived from the Latin *aqua*, we have testimony of their former celebrity as watering-places.

The reputation of thermal springs for medicinal and bathing purposes has descended to the present day, as the spas of Europe and our own watering places prove. In this practical age, however, we have shorn the springs of the superstitions of the ancients, and the busy habits of modern times do not admit of the time and elaborate preparation that was bestowed upon the bath in the luxurious days of Imperial Rome.

In the limited space at command here it is obviously impossible to describe all the springs of our own country, and much less those of the world. I shall therefore content myself with referring to a few of the most noted localities, and comparing them with our own celebrated region, viz: the Yellowstone National Park in Northwestern Wyoming Territory.

Thermal springs, like all mineral springs, may be divided according to their mineral constituents. For the purposes of this article a division into Simple Springs, Mud Springs or Salses, and Agitated Springs, and Geysers, is sufficient. By simple thermal springs, I mean those that are always quiet and whose temperature does not reach the boiling point. They are found all over the world, and may be pure, chalybeate, saline, sulphuretted, or carbonated. In the United States we have them in the Appalachian region, in Arkansas, and in the Rocky Mountains and westward.

I have already referred the source of the heat of thermal springs to subterranean heated rocks, and have spoken of the frequent relation of that heat to volcanic action.

In the Appalachian region we have comparatively low temperatures, and we can not usually explain the heat of the water by reference to volcanic action, unless we suppose the volcanic rocks to be so far below the surface that a large portion of the heat is lost by the water on its passage to the surface. Rogers attributed the temperature of the springs of the Appalachians to the normal downward increase of temperature. This is, in part, at least, probably due to the motion attending the uplifting, plication, folding, and crushing of rocks, in the process of mountain building, which Mallet has demonstrated to be an efficient source of heat and of geological work.

Mr. G. K. Gilbert has pointed out the fact that the distribution of thermal springs coincides with that of mountain corrugation, there being none in undisturbed regions and few in regions of little disturbance. The Arkansas hot springs can be referred to the

Ozark mountain disturbance. In the Rocky mountain regions we have generally higher temperature, which may be accounted for in part, perhaps, by the geologically recent age of the mountains, and in part, by the presence of volcanic rocks at or near the surface. The latter is especially the case in the Yellowstone Park, and it is not to be doubted that the origin of the heat of its springs must be sought for, in part at least, in the causes which have led to the floods of igneous material that cover the area in which they are found.

Another interesting point to notice is the source of the water. Aristotle taught that there were large cavities in the interior of the earth filled with air, and that this air condensed to water on the cold roofs, and made its way to the surface through fissures. Vitruvius believed that springs were due to an accumulation in subterranean reservoirs of rain and melted snow. Descartes imagined that the source of the water was the sea, from which water flowed into subterranean caverns, was vaporized and afterwards condensed, finally escaping to the surface through crevices in the rocks. Mariotte and Halley independently demonstrated that the fall of water in the form of snow, rain, and dew, is sufficient to account for all the water of rivers and springs. There may also be some truth in the idea of Descartes, and certain springs may be due to communication with the ocean.

Water penetrating the earth dissolves some of its mineral constituents, and when it reappears we have a mineral spring, the temperature of which depends, as Arago proved, upon the depth from which it comes, or the presence of volcanic rocks.

The springs of the Yellowstone National Park were first investigated by the Geological Survey of Dr. Hayden, in 1871, although in previous years there were rumors of burning plains, boiling springs, volcanoes of mud, and other wonders of which most astounding tales were told. A pleasure party had also visited some of the localities in 1870, but Dr. F. V. Hayden took the first *scientific* party into the region.

One of the most remarkable developments of thermal springs discovered by the Hayden expedition, is that of the "Mammoth White Mountain Hot Springs of Gardiner's River." They are on Gardiner's river, a few miles above its junction with the Yellowstone river. The deposits are white, and composed mainly of carbonate of lime, left as the sediment of both extinct and active

springs. They occupy an area of about three square miles, filling a gorge that extends more than two miles from the river, and the elevation of which, at the head, is 1,000 feet above the river. The greater part of the area is occupied by the ruins of springs, which are often covered with soil, and even overgrown with pines that commenced to grow long after the springs became extinct. Some of them must be hundreds of years old. Still in many places the outlines of the old basins can be traced. The principal springs are located about half way up the ravine. Leaving the river we ascend the hill of calcareous deposit, which gives forth a hollow sound beneath the tread of our horses. This hill must have been the seat of active springs ages ago. Turning to the left we come suddenly upon the marvelous scene. Before us rises one of the finest of nature's architectural efforts, a mass of snowy white deposits 200 feet high. Words are almost inadequate to convey to the reader a satisfactory idea of this mass, which is fringed with beautiful semicircular basins, having regular edges with exquisitely scalloped borders. These basins have been called Jupiter's baths and Diana's pools. They are irregular in size and shape, and filled with water of different temperatures, ranging from cold almost to the boiling point, forming most commodious bathing basins as elegant as could be devised by art. The springs are arranged on irregular terraces rising one above the other in steps. There are fourteen of these terraces with active springs. In 1871 the principal springs were on the ninth terrace, which is the top of the main mass of deposit, covering the space of about a square mile. The color of the water in these springs was of the purest azure. Clouds of steam were constantly rising from them, obscuring the view; but ever and anon a puff of wind would part the misty curtain, revealing the boiling surface bubbling in the caldron-like basins. In 1872 these springs had disappeared and new ones had made their appearance on the higher terraces.

The water flowing from the upper terraces becomes very much reduced in temperature by the time it reaches the lower ones. In many places are long rifts or fissures in the deposit, lined with sulphur. From them escape hot air and steam, laden with sulphurous odors, and the rumbling of the boiling waters far beneath can be distinctly heard. It requires but little exercise of the imagination to think that the giant Typhœus is confined somewhere below and struggling to escape from his prison.

On the lower terrace the basins are shallower and on the same general level. From among them rise several curious chimney-like masses, composed of layer upon layer of the hardened deposit. One of these, from its peculiar shape, was named the Liberty Cap. It is fifty feet high, and about twenty feet in diameter at the base. These chimneys probably mark the positions of former geysers. Near the head of the ravine are several miniature geysers. To appreciate the beauty of these springs and their wonderful formations, one must climb from terrace to terrace, and study them in detail.

The temperatures of the water range from 92° F. to 162° F., the boiling point at the locality varying from 199.5° to 200.9°, according to elevation. The hot water coming up through fissures in the igneous rocks passes through limestones, from which it derives the greater part of its calcareous ingredients. The deposits rest partly on limestone and partly on igneous rocks.

In New Zealand is a formation which in appearance resembles the Mammoth White Mountain Springs. It is called the "Te-Tarata," or tattooed stone. Instead of being calcareous it is silicious, and would properly, therefore, be classed with geysers, especially as it is an agitated spring. I quote the following description from Hochstrether, and the resemblance to our own formation will be at once apparent:

"About eighty feet above the lake (*Rotomahana*) on the fern-clad slope of a hill, from which in various places hot vapors are escaping, there lies the immense boiling caldron in a crater-like excavation, with steep reddish sides, thirty to forty feet high, and open only on the lake side towards the west. The basin of the spring is about eighty feet long and sixty wide, and filled to the brim with perfectly clear, transparent water, which, in the snow-white incrusted basin, appears of a beautiful blue like the blue turquoise. Immense clouds of steam reflecting the beautiful blue of the basin curl up, generally obstructing the view of the whole surface of water; but the noise of the boiling and seething is always distinctly audible."

The native who acted as guide to Hochstrether, informed him that sometimes the whole mass of water is thrown out of the basin with immense force. "If this be true," says Hochstrether, "then the Te-Tarata spring is a geyser playing at long intervals, the eruptions of which equal in grandeur the famous eruptions of the Great Geyser in Iceland. The Te-Tarata basin is larger than the Geyser basin; the mass of water thrown out therefore must be immense." "The

deposit of the water is like that of the Iceland springs, silicious, not calcareous, and the silicious deposits and incrustations of the constantly overflowing water have formed on the slope of the hill a system of terraces, which, as if cut from marble, present an aspect which no description nor illustration is able to represent. It has the appearance of a cataract plunging over shelves, which, as it falls, is suddenly turned into stone." "The flat-spreading foot of the terraces extends far into the lake. There the terraces commence with low shelves containing shallow water basins. The farther up, the higher grow the terraces; two, three, also four feet high. They are formed by a number of semicircular stages, of which, however, not two are of the same height. Each of these stages has a small raised margin, from which slender stalactites are hanging down upon the lower stage; and each encircles on its platform one or more basins resplendent with the most beautiful blue water."

The springs at the site of the ancient city of Hierapolis, in Asia Minor, six miles from Laodicea, are similar to those of Gardiner's river, and those of New Zealand just described. The following is the description of them by Prof. J. Lawrence Smith: "The site is seen for many miles before it is reached, as it rises abruptly from the north side of an extensive plain, and the sides of the hill are covered with an incrustation of dazzling whiteness for upward of a mile in length, and from this it has received its present name, *Pambuk-Kelescy* (cotton castle). Its thermal waters have always been its principal object of note, as evinced by the extensive ruins of baths. In fact, the very hill upon which the city stands owes its formation to the deposition of carbonate of lime from these waters, and it now rises upward of a hundred feet above the plain, with a width of about six hundred feet. Immediately behind the city rises another set of hills of calcareous rock, from which flow the waters in question." "The amount of water is very great, and it is so highly charged with carbonate of lime, as to incrust all bodies that it comes in contact with; and it takes place so rapidly that the concretion does not possess great solidity, and frequently has a granular form, resembling driven snow."

"In some places, as the waters flow over the steeply-inclined sides of the hill, it forms a succession of terraces at regular distances, that require but little effort of the imagination to liken to an amphitheatre with its marble seats. At other places it flows over the precipitous sides sixty or seventy feet high, and one or two hun-

dred feet wide, incrusting the precipice with a snow-white sheet, which might be likened to a consolidated cataract; and, what adds to the delusion, at the base the incrustations have accumulated an irregular mass not unlike foam. This petrified stream extends several hundred feet into the plain. It has formed walls and dikes, and incrusts the grass and vegetation that it flows over, and many of the tufts of grass, in perfect verdure, are thickly incrusted near the roots with this white carbonate of lime."

The resemblance of these springs and those of New Zealand to our Gardiner's river springs is apparent. In all three we have the arrangement in terraces and the general resemblance to a frozen cascade. The petrifying quality of the springs is particularly true of all calcareous and silicious springs. At the "Soda Springs" on Bear river, in Utah, are plants coated with calcareous material, the shape of each twig and leaf being perfectly retained The settlers call the springs, "Petrifying Springs." At the springs on Gardiner's river, the same thing is noticed in process of formation; and in the Geyser region of Fire Hole river, in the Yellowstone Park, wood is in process of silicification, by being permeated by silica from the water of the springs. Pine cones, and even butterflies that had fallen into the springs, were noticed rapidly becoming encrusted. The springs of Iceland all present similar phenomena. Strabo relates of the waters of the springs of Hierapolis that the people of the city conducted the waters along the vineyards and gardens, wherever they wanted a wall, and the channels became long fences, each a single stone, formed from the deposits left by the water.

In connection with this subject, the following legend related by Quintus Smyrnaeus, in reference to the *catacecaumene* or burnt district, in Lydia, about 100 miles east of Smyrna, is interesting. "When formerly divine Luna, viewing above from heaven Endymion sleeping by the side of his oxen, came down to him, for a passionate longing for the youth had seized upon the immortal lover. And of her nuptial bed there exists even now a memorial underneath the oaks, for round about this spot the milk of the cows was shed among the trees, and mortals behold it with astonishment; for seeing it from afar you would say that it was white milk, and yet fresh water gushes out from it; and when you have drawn near, it concretes around the very currents and becomes at length a marble floor."

Some of the most interesting forms of Thermal springs are Salses, or mud springs and mud volcanoes. When the springs force their way through beds of clay we have a mud spring, the consistency of which will depend on the amount of water in it. Some of these springs appear to dry up in the summer when the amount of surface water draining into them is small. The mud will often be so thick that it will be formed into conical masses by the steam in its efforts to escape, and when it succeeds in freeing itself the mud will be projected to some distance with a thud-like noise.

Some of them are real geysers, others turbid or quiet mud springs, and still others are constantly agitated. They assume, therefore, the same forms as the other springs, simply modified by the water passing through beds of clay. Some springs resemble kettles of boiling soap, while others look like pots of thick mush. The Yellowstone region is full of examples of mud springs, most of which are described in full in the reports of the Hayden Geological Survey. I shall refer to but a few of the localities here.

A place named Mud Volcanoes, a few miles below Yellowstone Lake, on the river, is the typical locality of mud springs for the Park. There is a large collection of mud springs of different kinds, and the dense clouds of steam rising from them point out the locality some time before the traveler reaches it, and as he draws near the noise produced by the throbbing of the agitated mud becomes more and more distinct until he is in the midst of the seething caldrons. The first spring that attracts notice is the Giants' Caldron. It is located on the side of a small hill, and is remarkable for several things. It does not boil with an impulse like most of the mud pots, but with a constant roar which shakes the ground. It has a circular orifice some twenty feet in diameter, and from it there is ever rising a dense column of steam, which obscures the view of the constantly agitated mass of thin, black mud, seething and boiling some twenty feet below the suface. The trees within a radius of a hundred feet or more from the caldron are coated with mud. It is a question whether this mud was deposited during an eruption, or from having been carried up in the steam and left on the trees by evaporation. The constant agitation of the spring is evidence against its being a geyser. Another interesting spring in the group is the "Grotto." At regular intervals of a few seconds a vast column of steam bursts from a cavern in the side of the hill with a pulsation that shakes the ground. The

roaring of the waters in the cavern and the noise of the waters as they surge up to the mouth of the opening are like that of the billows lashing the sea-shore. The water is clear as crystal, and the steam is so hot that it is only when a breeze wafts it aside for a moment that one can venture to look into the opening. This is the only spring in the group which is not a mud spring, and it is the only one that does not pass through a clay bed, the cavern being in sandstone. The most interesting of them all, however, is the Mud Geyser. The following is the description of one of its eruptions, which take place about every four hours:

The water gradually rises in the basin until it is filled, this process taking place in the interval. When it is entirely full, a slight bubbling is noticed in the centre, and suddenly, without any further warning, it becomes violently agitated, and an immense mass of muddy water, mingled with clouds of steam, is thrown into the air. This action lasts a few minutes, and is followed by a lull, the action not ceasing entirely. Then it begins with renewed violence, and the waves fill the entire outer basin as well as the inner, the water striking the banks in a succession of waves. The water is thrown up in a succession of impulses that follow each other rapidly; and sometimes the water is thrown obliquely, and seems as though it would overwhelm one standing on the bank. The mass of mud and water seems immense. After the maximum height (forty feet) is obtained, the jets become smaller and the eruption ends as suddenly as it began, the water disappearing from sight. It is very impressive, and the stopping is like a calm after a storm. The water of the geyser is very muddy, and bluish in color. Mud springs are found at various points on the shores of Yellowstone Lake, and also in the Geyser Basins of Fire Hole River. I shall describe only the "Mud Puffs" of the Lower Basin. It is a large elliptical caldron filled with thick mud of various colors, pink and white predominating. The surface is depressed below the edge of the basin, and resembles a large mortar bed. The sputtering surface is covered with small cones or puffs by the escaping steam, and as they burst the mud spurts upwards for several feet. The mud is almost impalpable, having been worked and reworked by the escaping steam for ages perhaps.

Among the many descriptions of mud springs in New Zealand by Hochstrether is the following: "The bottom of the ravine is formed by fine mud, and thick, burst and broken plates of deposit

lie scattered about like cakes of floating ice after a thaw. Here and there a deep basin full of water is boiling; next to this lies a terrible hole emitting hissing jets of steam; and farther on, small mud-cones are seen, from two to five feet high, vomiting forth, volcano-like, from their craters, hot mud with a deadened rumbling, and imitating, on a small scale the play of large fire volcanoes." Iceland has long been celebrated for its hot springs and geysers, and among them are found the same kind of mud springs seen in other localities. S. Baring Gould, in his "Iceland," gives a graphic description as follows: "Picture to yourself a plain of mud, the wash from the hills, bounded by a lava field; the mountains steaming to their very tops, and depositing sulphur, the primrose hue of which gives extraordinary brightness to the landscape. From the plain vast clouds of steam rise into the air, and roll in heavy whorls before the wind, whilst a low drumming sound proceeding from them tells of the fearful agencies at work." "It is not pleasant walking over the mud; you feel that only a thin crust separates you from the scalding matter below, which is relieving itself at the steaming vents. These vents are in great numbers, but there are especially twelve large caldrons in which the slime is boiling. In some the mud is thick as treacle; in others, it is simply ink-black water. The thundering and throbbing of these boilers, the thud-thud of the hot waves chafing their barriers; the hissing and spluttering of the smaller fumaroles, the plop-plop of the little mud pools, and above all the scream of a steam whistle at the edge of a blue slime pool, produce an effect truly horrible. In some of the caldrons the mud is boiling furiously, sending sundry squirts into the air; in others bells of black filth rise and explode into scalding sprinklings; in one a foaming curd forms on the fluid, and the whole mass palpitates gently for a moment, then throbs violently, surges up the well, and bursts into a frenzied, roaring pool of slush, squirting, reeling, whirling in paroxysms against the crumbling sides, which melt like butter before its fury. One or two of the springs have heaped themselves up mounds around their orifices; others, however, gape in the surface without warning; and the steam is so dense, and the sulphurous fumes so suffocating, that one becomes bewildered and can hardly pick one's way among them."

I have quoted this description somewhat at length, for the phenomena described are so exactly similar to those of the Yellowstone region, that one could almost imagine the writer to be speaking of them, rather than of the Iceland springs.

Salses also occur abundantly in Java. Dr. Horsfield describes one locality as follows: "About the centre of the limestone district is found an extraordinary volcanic phenomenon. On approaching the spot from a distance it is first discovered by a large volume of smoke, rising and disappearing at intervals of a few seconds, resembling the vapors arising from a violent surf, whilst a dull noise is heard like that of distant thunder. Having advanced so near that the vision was no longer impeded by the smoke, a large hemispherical mass was observed, consisting of a black earth mixed with water, about sixteen feet in diameter, rising to the height of twenty or thirty feet in a perfectly regular manner, and, as it were, pushed up by a force beneath, which suddenly exploded with a dull noise and scattered about a volume of black mud in every direction. After an interval of two or three, or sometimes four or five seconds, the hemispherical body of mud or earth rose and exploded again."

M. de Verneuil gives a description of a mud-volcano in the peninsula of Taman. He states that, "in the peninsula of Taman and on the eastern side of the Crimea, the country is covered with hills of a conical form, more or less regular, which rise to the height of two hundred and fifty feet, and owe their origin to eruptions of mud. The eruptions are accompanied by subterranean noises, jets of viscous matter carried to a great height, quakings of the ground, evolutions of gas and flame, smoke and springs of water charged with bitumen."

Mud volcanoes have been among the most terrific in their effects. Whole islands have been due to their agency. The island of Taman, which seems to owe its origin to mud eruptions of an early period, is surrounded by others owing to the same causes, which are constantly at work. That some of them have been upheaved within the historic era may be inferred, says Sir Roderic Murchison, from the fact that on the walls of the fortress of Suda, near Theodosia, in the Crimea, are some stones procured from coast cliffs which contain species of shells now living in the adjacent Black Sea, and which we are disposed to think must have been thrown up on the line of the eruption of the mud volcanoes, and parallel to the axis of the Caucasus. It is probable that the island which Aristotle notices as having made its appearance off the coast of Pontus was due to the operation of mud volcanoes. There is a notable mud volcano at the hill of Macaluba, near Girgenti, in Sicily, to which Plato, in his Phædon, probably alludes when he speaks of the torrent of mud which is in Sicily.

Mud volcanoes appear to hold about the same relations to mud springs that geysers do to the quiet springs. The word geyser is derived from the Icelandic word *geysa*, to rush, to be impelled; and is applied to those hot springs from which a column of water is expelled at intervals. The three principal geyser fields of the world are those of Iceland, New Zealand and our own Yellowstone National Park. The geysers of California are a collection of interesting hot springs, but the water is not thrown to a greater height than fifteen or twenty feet, and the phenomena are not analogous to true geysers.

The earliest mention of the geysers of Iceland is made by Saxo Grammaticus, in his preface to the History of Denmark, which proves them to have existed for more than 600 years. The area occupied by them does not exceed twelve acres, and besides the "Great Geyser" and the Strokr, which are the principal geysers, it contains large blue springs, steam jets, and mud springs. The "Great Geyser" is on a mound of silicious sinter of a brownish-gray color, thirty feet in height. It slopes on all sides to the distance of about a hundred feet from the large basin on its summit. The basin or bowl in the centre is funnel-shaped, about fifty feet in diameter and four or five feet deep, sloping gradually to the centre, which is about sixteen feet in diameter, decreasing to ten or twelve feet. From this orifice the water is projected during an eruption, one of which is thus described by Baring Gould: "Five strokes underground were the signal, then an overflow, wetting every side of the mound. Presently a dome of water rose in the centre of the basin and fell again, immediately to be followed by a fresh bell, which sprang into the air full forty feet high, accompanied by a roaring burst of steam. Instantly the fountain began to play with the utmost violence, a column rushed up to the height of ninety or one hundred feet against the gray night sky, with mighty volumes of white steam-cloud rolling about it, and swept off by the breeze to fall in torrents of hot rain. Jets and lines of water tore their way through the cloud, or leaped high above its domed mass. The earth trembled and throbbed during the explosion, then the column sank, started up again, dropped once more, and seemed to be sucked back into earth."

Erasmus Darwin, in his *Botanic Garden*, has the following lines on the Great Geyser:

"High in the frozen North where Hecla glows,
And melts in torrents his coeval snows,
O'er isles and oceans sheds a sanguine light,
And shoots red stars amid the ebon night;
When, at his base entombed, with bellowing sound
Fell Geyser roared, and, struggling, shook the ground;
Poured from red nostrils, with her scalding breath,
A boiling deluge o'er the blasted heath;
And wide in air its misty volumes hurled
Contagious atoms o'er the alarmed world;
Nymphs your bold myriads broke the infernal spell,
And crushed the sorceress in her flinty cell."

The height to which the "Great Geyser" throws the water probably varies with the time of the year and with each eruption. The following are the estimates given by different travelers:

Olafson and Povelson,	360 feet.
Von Troll,	92 "
Sir John Stanley (by quadrant),	96 "
Dr. Hooker,	100 "
Mr. Henderson,	150 "
Sir Geo. McKenzie,	90 "
Mr. Barrow,	80 "
S. Baring Gould	90 "

The first—360 feet—is probably an exaggeration, as the others agree closely. The temperature of the water is from 180° to 190° F.

The natives assert that animals have fallen into one geyser and their bones afterward been projected from another. Some of the effects attributed to the geysers would be most wonderful, if only true. Thus Horrebow says that if some of the water be put in a bottle, whenever the geyser has an eruption the water in the bottle, probably by some sympathetic action, will also be agitated, and if the bottle be corked, it will be burst.

The New Zealand geyser field has already been referred to.

Our own region includes three geyser fields, viz: the Lower and Upper Geyser Basins of Fire Hole river, and the Shoshone Geyser basin. These include thousands of springs, which like those of Iceland may be divided into three classes: 1st. True geysers, from which the water is thrown at stated intervals. 2d. Constantly agitated springs, or those which are always boiling. 3d. Those which are always tranquil. These are generally lowest in temperature.

The Lower Geyser Basin of Fire Hole river contains between twenty-five and thirty square miles in which the springs are scattered in groups. There are several important geysers, of which the Architectural or Great Fountain is the largest. The following description is by Mr. Holmes, of the Hayden expedition: "Surrounding the crater is a table raised about two feet above the general level and 120 feet in diameter. This is formed of silicious sinter, with exquisitely modeled pockets or basins with ornamented rims depressed below its surface. The crater is in the centre, about ten feet in diameter, lined with an irregular coating of beaded silica. The water soon began to rise, plunging from side to side in great surges, sending up masses of steam and emitting angry rumbling sounds. An irregular mass of water was thrown into the air in the utmost confusion, spreading out at every angle and whirling in every direction, some jets rising vertically to the height of sixty or eighty feet, then separating into large glistening drops and falling back into the whirling mass of water and steam; others shooting at an angle of 45° and falling upon the islands and pools thirty or forty feet from the base. The eruptive force for a moment dies away, and the water sinks back into the tube. Then, with another tremendous effort, a second body of water is driven into the air, but with a motion so much more simple than before that the whole mass assumes a more regular form, and is like a great fountain with a thousand jets, describing curves almost equal on all sides, and forming a symmetrical whole more varied and more grand than any similar work by man. The intermittent action continues for nearly an hour, but is so constantly changing that at no two moments during that time are the forms or movement the same. The eruptions are repeated at irregular intervals of a few hours. The temperatures of the springs in the Lower Basin range from 106° F. to 199° F., or almost to the boiling point, which is a fraction over 199° F. in that region. The Upper Geyser basin of Fire Hole river, although smaller (only about two miles long by an average width of half a mile), contains within its limits the principal geysers. For descriptions of all, the reader will have to refer to the Reports of the United States Geological Survey, as the space here permits of but a few being described. Unless the eruptions of the "Grand Geyser" had been witnessed, one would scarcely take it for the most important geyser in the basin; for unlike most of the others, it has no raised cone or crater,

its basin or bowl being sunk below the general level. The basin is fifty feet in diameter, and one foot in depth. In the centre the mouth of the Geyser tube measures four by two feet. The first eruption of the geyser was witnessed in 1871. We had just camped on the opposite side of the river when a tremendous rumbling was heard shaking the ground in every direction. It would be difficult to describe the feelings of excitement with which we saw the immense mass of water and steam shoot from the crater to a height of over 200 feet from the earth, utterly unaccustomed as we were to such phenomena. The eruption consisted of three distinct periods, after each of which the water sank completely out of sight. During the spouting, the water is carried up in a succession of jets, the main mass of water being very large. Through it a column shoots at intervals to the maximum height (175 to over 200 feet). The shape of the entire column is pyramidal. Immense clouds of steam accompany the water, and the latter in falling back shakes the ground. After the eruption, the water disappears, to fill the basin again gradually until the next eruption after an interval of twenty-five to thirty hours.

The Giantess is another geyser that has no mound. It is a pool 23½ by 32½ feet, and 63 in depth. Its eruptions usually occur at long intervals. Mr. N. P. Langford, who was the first to witness an eruption, thus graphically describes one: "The grand eruption continued for twenty minutes, and was the most magnificent sight we ever witnessed. We were standing on the side of the geyser nearest the sun, the gleams of which filled the sparkling column of water and spray with myriads of rainbows, whose arches were constantly changing—dipping and fluttering hither and thither, and disappearing only to be succeeded by others, again and again amidst the aqueous column, while the minute globules into which the spent jets were diffused when falling, sparkled like a shower of diamonds, and around every shadow which the denser cloud of vapor, interrupting the sun's rays, cast upon the column, could be seen a luminous circle, radiant with all the colors of the prism, and resembling the halo of glory represented in paintings as encircling the head of Divinity. All that we had previously witnessed seemed tame in comparison with the perfect grandeur and beauty of this display." The Castle has a cone 11 feet high. The eruptions often last nearly two hours, consisting first of water and afterwards of steam. The noise is indescribable. Imagine a gigantic

pot with a thunder storm in its stomach, and to the noises of elemental war add the shrieking of steam pipes, and one may then have a faint idea of of it. After the eruption the exhausted geyser sinks into complete repose. The Bee Hive has a peculiar action. From a cone 3 feet high, a steady, fan-shaped stream of water and vapor is projected 100 to 250 feet. No water falls back, but it seems to be all resolved into vapor. "Old Faithful" has an eruption every hour, and was named from its regularity. Scattered throughout the valley are several blue hot springs, like those of Iceland and New Zealand. One near the Castle Geyser has been fancifully named "Circe's Boudoir." The water is perfectly transparent, and so intensely blue, that one involuntarily plunges the hand in to see if it is water. The basin is of pure white silica, looking like marble. It is about 20 feet in diameter, and has a beautiful and regularly scalloped margin. The white basin slopes inward to a funnel-shaped opening which is 40 feet deep, and over this the water is most intensely blue, its temperature 180° F. The Geysers of the "Shoshone" Basin, although less active than those of the Fire Hole, are unsurpassed in beauty. They are at the extreme western end of the western arm of Shoshone lake, at the head of one of the branches of Snake River. The "Union," the "Minute Man," and the "Shield" are the principal geysers. The first is the most important, and is named from its combining the various forms of geyseric action. It will be easily seen that our geyser region not only exceeds all others in extent, but also in the variety of the springs and their products. Almost all the springs are at the boiling point in the upper Geyser Basin, and the deposits are silicious geyserite.

Following are the heights of the eruptions of the principal geysers:

				Height in feet.
Fountain	Lower Geyser Basin,	Fire Hole		30 to 60
Architectural	"	"	"	60 to 80
Steady	"	"	"	5 to 20
Young Hopeful	"	"	"	10
Grotto	Upper Geyser Basin,	Fire Hole		25 to 60
Giant	"	"	"	140
Giantess	"	"	"	39 to 250
Castle	"	"	"	50 to 250
Grand	"	"	"	173 to 250
Turban	"	"	"	25 to 30
Bee Hive	"	"	"	100 to 219

Old Faithful.....	Upper Geyser Basin, Fire Hole.....	100 to 150
Saw Mill.....	" " "	15
Solitary.....	" " "	50 to 70
Union.....	Shoshone Geyser Basin.....	70 to 92
Minute Man.....	" "	30 to 40

I shall conclude with a few remarks on the theory of the geyser. One of the oldest was that of McKenzie. He thought there were underground cavernous recesses containing air, the pressure upon which, after an explosion, caused the action of the geyser.

Mr. Dony, of Ghent, discovered that water long boiled becomes more and more free from air, by which its molecular cohesion is greatly increased, and when the heat is great enough to overcome this cohesion, the production of steam is instantaneous. Bunsen, in a series of investigations among the geysers of Iceland, found that just before an eruption at no point in the geyser tube was the water at the boiling point. He also noticed, as has always been noted in the Yellowstone geysers, that immediately preceding the eruptions the water always rises in the basin. In descending the geyser tube the temperatures increased; so also does the boiling point. Now suppose the steam coming in by ducts below raises the water. The heated water is then raised to a level where its temperature is in excess of that necessary to make it boil, and this excess of heat is applied to the generation of steam, and as a consequence the column of water is raised still higher. More steam is formed; from the middle downwards the mass suddenly bursts into ebullition, and the column of water mingled with steam is projected into the air. Dana in his Manual of Geology, substantially in agreement with Bunsen, ascribes the geysers to—

1. Access of subterranean waters to hot rocks, producing steam which seeks exit by conduits upward.

2. To cooler superficial waters descending those conduits to where the steam prevents farther descent, and gradually accumulating until the conduit is filled to the top.

3. To the heating up of these upper waters by the steam from below, too near the boiling point, when (4) the lower portion of these waters becomes converted into steam, and the jet of water or eruption ensues.

Bischof's idea is that "the intermitting springs of Iceland are probably caused by the existence of caverns in which the vapor is retained by the pressure of the column of water in the channel which leads to the surface. Here this vapor collects and presses

the water in the cavern downward until its elastic force becomes sufficiently great to effect a passage through the colnmn of water which confines it. The violent escape of the vapor causes the thunder-like subterranean sound and the trembling of the earth which precedes each eruption. The vapors do not appear at the surface till they have heated the water to their own temperature. When so much vapor has escaped that the expansive force of that which remains has become less than the pressure of the confining column of water, tranquillity is restored, and this lasts until such a quantity of vapor is again collected as to produce a fresh eruption."

Prof. Theo. B. Comstock, who visited the Yellowstone National Park in 1873, while thinking Bunsen's theory adequate to explain the prominent features of geyser eruptions, believes that a modification of Bischof's theory should be combined with it in order to explain some of the phenomena observed. Bischof's theory is easily demonstrated by experiment. If an iron tube about six feet in length, surmounted by a basin, be filled with water, heated below, and, to imitate the high temperature at a corresponding point of the geyser, also about two feet from the bottom, every five minutes the water will be projected from the tube into the air, being thus a miniature geyser.

We have learned just sufficient to know how desirable further investigation and study is. No locality in the world presents such a favorable field as our "National Park," and it is to be hoped that systematic researches will be prosecuted there at no distant day.

It is well known that the geyser water deposits no sediment, no matter how long it is kept. How then are the tube and crater formed? Simply by evaporation. Tyndall gives the following description of the process: "If we place a quantity of the geyser water in an evaporating basin the following takes place: In the centre of the basin the liquid deposits nothing, but at the sides, where it is drawn up by capillary attraction, and thus subjected to speedy evaporation, we find silica deposited. Round the edge a ring of silica is laid on, and not until the evaporation has continued a considerable time do we find the slightest turbidity in the middle of the water. This experiment is the microscopic representant of what occurs in Iceland. Imagine the case of a simple thermal silicious spring, whose waters trickle down a gentle incline; the water thus exposed evaporates speedily, and silica is deposited. This deposit gradually elevates the side over which the

water passes, until finally the latter has to take another course. The same takes place here, the ground is elevated as before, and the spring has to move forward. Thus it is compelled to travel round and round, discharging its silica and deepening the shaft in which it dwells, until finally, in the course of ages, the simple spring has produced that wonderful apparatus which has so long puzzled and astonished both the traveler and the philosopher."

Hot springs are therefore similar the world over, and are modified by various circumstances. It is a remarkable fact and one gratifying to us as Americans, that within the tract known as the "Yellowstone National Park," we can find such a variety of springs as no other part of the world can present. The setting aside of this area by the Forty-first Congress was the result of the Expedition of Dr. F. V. Hayden, in 1871, and was due largely to his personal efforts, for which all students of science will ever be thankful.

A. C. PEALE.

HAECKEL'S GENESIS OF MAN, OR HISTORY OF THE DEVELOPMENT OF THE HUMAN RACE.[1]

[THIRD AND CONCLUDING PAPER.]

PHYLOGENESIS.

THE fundamental biogenetic law that ontogenesis is an abridged repetition of phylogenesis, that the transformations through which the individual passes during its ante-natal and post-natal existence in the brief period of its career are a mere reflection of those through which its race has passed during the long ages of its slow development, and that the latter process is the strict physical and mechanical cause of the former,—this deepest of all biological laws Haeckel no longer treats as a *theorem* requiring demonstration, but employs it as a *postulate* by the aid of which all the most troublesome gaps left in the anthropogenetic series by the evidences of comparative anatomy, paleontology, and geographical distribution (*chorology*), are satisfactorily closed. Such gaps have existed along the entire line, rendering it difficult and in many cases impossible

[1] Anthropogenie, oder Entwickelungsgeschite des Menschen, von Ernst Haeckel, Professor an der Universität Jena. Leipzig, 1874.

to trace it, and leaving so large a part of the whole theory of descent a matter of conjecture, that it was easy for those so disposed to point out unanswerable objections. But once admit the facts of ontogenesis, and miracle alone, and this of the most incredible kind, is the only alternative to the acceptance of the fundamental law, which candidly viewed in the light of these facts, bears every mark of inherent probability. Not only does this law fill out numerous voids and supply many wholly "missing links" in the phylogenetic chain, but it also confirms in the most remarkable manner nearly every item of the evidence furnished by the other sources of proof of the doctrine of descent.

Great indeed was the step which this doctrine took when the remarkable revelation was made in the domain of comparative anatomy, that the Amphioxus possessed a *chorda dorsalis*, and that the Ascidian larva contained an even more distinct trace or rudiment of a vertebral column. Professional naturalists without preconceived ideas could no longer resist the inference that here was the true *nexus* between the worms and the vertebrates. Consider now the almost crucial verification which this hypothesis received when it was found that the embryonic stages of every creature higher in the scale of being than the Amphioxus presents phases identical with those of that animal and of the Ascidiae, that even the human embryo has its worm-stage immediately succeeded by its Chordonium stage, and this again by its Acranial stage; the collateral proofs extending even to the germinative layers, and thus rendering the correspondence complete and the inference irresistable. Equally pointed illustrations might be drawn from many other points along the line of common descent.

But valuable as is this class of evidence at these comparatively advanced stages, it is still more so far down toward the dawn of organic existence. For while in the former it only serves to supply the omissions or verify the testimony of an array of paleontological, anatomical, and chorological facts, in the latter it stands alone as the sole evidence of a tangible character of the development of living forms out of the primordial and unorganized *plasma* of nature, and indeed from inorganic matter itself. These ontogenetic stages have already been considered, and unavoidable mention made of many of the forms to which they correspond, and whose stamp they bear.

The deeper problem of the origin of life on the globe is one

which strictly belongs to phylogeny, and one which Haeckel has not hesitated squarely and boldly to meet. The doctrine of spontaneous generation, or *archigonia*, is by no means so simple as many suppose, and is not to be settled by either the supposed success or failure to originate bacteria, diatoms, and monads, under certain conditions, in organic infusions.

The only form of generation which has ever yet come within the scope of human observation, and which, from the nature of things, can ever be expected to be directly witnessed by human eyes, is, of course, that wherein the offspring proceeds directly from a known and distinct parent age. This form of generation is called *tocogonia*, and genesis itself in its widest sense is therefore primarily divided into *archigonia* and *tocogonia*.

The exceedingly complicated subdivision of tocogonia must be passed over, as we need consider here only the simpler but still somewhat complex one of archigonia, or original spontaneous generation. Although nothing is perhaps empirically known respecting this process, its existence as forming the first link in the phylogenetic chain possesses the highest degree of probability *a priori*, which is not at all lessened by any empirical failures to subject it to the testimony of the senses.

The problem divides itself into two, which Haeckel considers distinct and independent. The phenomenon assumed by the one he calls *plasmogonia*, in which the genetic process is conceived as taking place in a fluid containing organic matter, which is supposed by some to be essential to the origination of life. The other form of archigonia, on the other hand, conceives the process as taking place in a medium consisting wholly of inorganic elements, and Haeckel accordingly denominates this process *autogonia*, *i. e.* unaided self-generation. It will be observed that the great majority of the experiments thus far tried have been confined to the first of these classes, or plasmogonia. If we now consider the second class, or autogonia, we perceive that this also presents a twofold problem. It is either a process which under certain rare and favorable conditions is going on at all times in some parts of Nature's domains, or it may be one which was only capable of taking place at one period in the geological history of the globe, when conditions existed which were quite different from those now existing, and that all the life now found on the globe has descended through the tocogonic process from the primordial organisms then created.

To all these questions but one answer can be given; but this is an answer which either must be given, or else the whole monistic theory must be surrendered. This answer is that *somewhere and at some time the organic world must have developed out of the inorganic.*

This is all we really *know*, but this we do know just as well as we know that the surface of the earth has undergone the changes which geology teaches that it has undergone. One of three things is certain; either organic life must have existed from eternity, or it must have been created specially, or it must have had a natural origin out of inorganic matter. The first of these contradicts all the facts of geology and all our modern ideas of the cosmogony of our system. The choice lies, therefore, between the other two, and for the consistent dysteleologist, there remains no alternative.

Haeckel, however, is undoubtedly too hasty in many of his sweeping assumptions respecting this problem, as for example, that of the direct autogonia of his moners, such as *Bathybius Haeckelii* of Huxley, who dredged it from the bottom of the Atlantic, where it exists in vast quantities as a strange unorganized mass of living protoplasm. Even this would doubtless be too great a *saltus* for Nature to make. It is certainly far more in harmony with Nature's processes generally, and with the whole tenor of the monistic or genetic philosophy, to conceive that between the two divisions of archigonia which he establishes, autogonia and plasmogonia, there is in Nature a regular gradation, as throughout the rest of her domain, and that she first develops the plasma, that is, some combination of organic matter, consisting of the necessary nitrogenized and carbon compounds in a high state of complexity and instability, and then, as a mere continuation of a uniform process, impresses this, first with the lowest and then with higher and still higher vital properties. For life is unquestionably a product of organization.

While, therefore, inorganic matter must be regarded as the primordial ancestor of all organized beings, the first stage in the genealogical development of all living things, and hence also of man, must have been some form of *moner*. Haeckel enumerates eight genera of moners now existing on the globe, and there can be no doubt that there are many more still undiscovered, and their extreme and absolutely structureless simplicity renders it highly probable that they are really the first form of life which was developed on the globe.

The direct descendants of the moners are undoubtedly the various forms of *amoeba*. About the only observable differentiation required to effect this transformation, is the development of a nucleus in the interior of the protoplasmic substance of the former creature. This change converts the *cytode* into a true *cell*, and such is the character of the amoeba, a simple individual of the first order. According to Haeckel, neither the moner nor the amoeba can be strictly classed either with animals or with plants. They belong, together with many other lowly-organized beings, such as the *Flagellata* or lash-cells, the diatoms and the rhizopods, to his famous *third kingdom*, the *Protista*. As moners, however, are the lowest of all forms of life, he divides these into three classes, animal moners, vegetable moners, and neutral moners. The first class develop into the lowest animal form, the *Protozoa;* the second into the lowest vegetable form, the *Protophyta;* and the third into the neutral form, the *Protista*. He also speaks of animal amoebæ, and seems to regard these creatures more nearly allied to animals than to plants. At least, he places both the moner and the amoebæ at the base of the animal scale, as the first and second terms of the phylogenetic series.

From the amoeba-group proceed the true Protozoa, which therefore stand in the anthropogenetic line. Applying now the biogenetic law to the *Morula-stage* of ontogenesis, and we are able to conclude that these animal amoebas, at one period in their history of development, formed societies or compound individuals (*Synamoebia*), which therefore constituted the corresponding third stage of development in the anthropogenetic line.

There must have next existed, as the fourth stage, a family of creatures standing at the base of the protozoa, whose bodies consisted of a simple hollow sphere, the walls of which were formed of a single layer of cells. These were the *Planaeada*, and they find their embryonic recapitulation in the blastosphaere stage. These creatures are not yet so far extinct but that representatives of them still exist in Haeckel's *Magosphaera*, in *Synura*, and in other marine and fresh-water forms.

The gastrula-form of embryonic development, barely traceable in the higher vertebrates, but common to both Amphioxus and Ascidiae, as well as to many lower forms, is all there is to warrant the assumption of a class of beings once peopling the waters of the globe, whose bodies consisted of a simple sack open at one end

and formed of two cellular layers. These were the interesting *Gastraeada*, which have given to all the forms that have descended from them the warp and woof of all their tissues, the primary germinative layers. They must have developed directly out of the *Planaeada*, and form the fifth stage in the descent of man.

Ontogenesis next points, as a sixth stage, to an extinct race of primordial worms, *Archelminthes*, which originated from the Gastraeada by the formation of an intermediary germinative layer, from which the two inner secondary layers eventually differentiated. These creatures belonged to the lowest sub-division of the worms, the *Acoelomi*, which, as their name implies, possess no cavity of the body (*coelom*) distinct from the sack-like stomach. They are also without any vascular system, heart, or blood, but manifest the first traces of the formation of a nervous system, the simplest organs of sense and rudiments of secretive and reproductive organs. The typical representatives of the *Archelminthes* are the *Turbellaria*, but they also closely resembled the parasitic Trematoda and Cestoda, which belong to the group *Acoelomi*. Thus is man connected by blood relationship with the loathsome tape-worm that infests his stomach!

Out of the *Acoelomi* were developed the *Coelomati*, which, still low in the scale, nevertheless possess a distinct *coelom*. The now extinct race which effected this transition have been called the *Scolecida*, and form the seventh stage of anthropogenetic development. The exact gap which they seem to have bridged over lay between the *Turbellaria* and the *Enteropneusta*, the last of which are represented by the well-known *Balanoglossus*. From this point the great articulate branch swung off, and a little higher the important branch of the Mollusks.

To arrive at the eighth stage we are again compelled to resort to the fundamental biogenetic law, and reason from the chordonium stage of embryonic development of all vertebrates to an extinct form, which must have possessed the rudiment of a vertebral column in the form of a *chorda dorsalis* as a permanent character of its adult state. It would have been wholly impossible to say whether this assumed creature should be placed in the department of articulates, mollusks or worms, were it not for the flood of light which the anatomy of the Amphioxus and the Ascidian has within the past few years shed upon the whole problem.

The existence of such a *chorda* in the former of these animals,

and its presence also in the larval forms of the latter, are two facts which point unmistakably to the type *Vermes* as the one which has furnished the transition to the vertebrata. No creatures have been found in any of the other types which afford the least intimation of any such transition, and neither in the Protozoa, the Zoophytes, the Echinodermata, the Crustacea, the Arthropoda, nor the Mollusca, has any trace of a *chorda dorsalis*, either in the larval or adult state, been detected after the most thorough examination. The conclusion is, therefore, irresistible, that the sub-kingdom Vermes and the class *Tunicata* have furnished the true progenitor of the vertebrates. This transition form itself has probably long been extinct, but it has left lineal representatives in the Ascidia, Phallusia, etc., which, while through long adaptation to a fixed existence during their adult state they have lost their *chorda*, still retain that distinctive character during their free larval state, as the unquestionable ontogenetic expression of an organ which they have inherited from their extinct chorda-bearing ancestor. This ancient and primordial ancestor of the vertebrate sub-kingdom to which so many facts, both of ontogenesis and of phylogenesis, with so great certainty point, Haeckel denominates the *Chordonium*. As if to put the solution of this important question beyond the possibility of a future doubt, it is now found that a member of this same group, the *Appendicularia*, actually preserves its chorda during life, and this creature may therefore be regarded as a now living representative of the true *Chordonium*.

The Amphioxus forms the ninth stage in the anthropogenetic line, and furnishes the first link in the vertebrate chain. It is the only known representative of the once great subdivision of vertebrates called by Haeckel the *Acrania*, or skulless vertebrates.[2] Of this wholly unique and extremely interesting creature sufficient mention has already been made.

The tenth stage is that of the *Monorhinæ* or *Cyclostoma*, which have for their best known representative the *Petromyzon* or lamprey. These arose out of the Acrania through a simple enlargement of the anterior extremity of the spinal nerve and the differentiation of the corresponding part of the *chorda dorsalis* into a rudimentary cranium. The distinctive circular mouth-orfice Haeckel regards as a mere adaptive character not present in the original progenitor of the *Craniota*.

[2] See note to second paper (May) page 364.

The transition to the eleventh, the Selachian or primordial fish-stage, took place through the formation of a pair of nostrils and a pair of jaws out of the simple circular mouth-orifice of the *Cyclostoma*. This transformation led to the *Amphirhinae*, a branch of the *Craniota*, systematically coördinate with the *Monorhinae*, but embracing all the rest of the vertebrate sub-kingdom. With the higher fishes (*Ganoides* and *Teleostei*) human genealogy is not immediately concerned, but only with the lowest sub-class, the *Selachii*, whose present living representatives are few, and comprise the sharks, rays, etc., but which formed in the Devonian age the chief population of the waters of the globe, as their singular heterocercal remains found in the rocks of that period abundantly attest.

The transition from the Selachians was next to the *Dipneusta*, which constitute the twelfth stage. It was brought about by the natural adaptation of the organs of the body to a partially terrestrial existence. The swim-bladders were transformed into imperfect lungs, the nasal orfices, which in fishes have no communication with the interior of the mouth, established such a communication, and the single auricle of the heart divided into two, thus correspondingly improving the circulation of the blood. The *Dipneusta* therefore employed their gills, which they retained, when in the water, but breathed through their lungs when on land. They form therefore a very anomalous and interesting transition group connecting the lowest fishes with the lowest amphibians. They were a very large class in paleolithic time, as their dental remains testify, but at present only three genera are known, each with a single species, viz.: *Protopterus annecteus*, of the rivers of Africa, *Lepidosiren paradoxa*, of tropical America, and *Ceratodus Forsteri*, from South Australian swamps.

Gegenbaur has demonstrated that the real character of the fins of fishes is that of many-toed feet. The changes that led from the fish to the Dipneusta seem not to have affected the number of these toes, although a certain adaptation of the fins to terrestrial locomotion was perceptible. The next important transformation was to concern this part of the animal anatomy. The animals nearest related to the Dipneusta are unquestionably the amphibians, with which the former are frequently classed; but they differ from them in the important respect of possessing regular five-toed feet. But one conclusion can be drawn from this fact, and this is that among the many and varied forms of the once great Dipneusta class, there

was one whose locomotive organs had become transformed through adaptation and natural selection into five-toed feet, and that from this long extinct five-toed progenitor, the present amphibians have descended. The human embryo itself, and that of all the higher vertebrates, pass through an analogous transition.

With frogs, toads, and other higher amphibians, as we are most familiar with them, the anthropogenetic line has no direct connection. It constantly hugs the base of the whole group, exhibiting direct relationships only with the *Sozobranchia*, which therefore form the thirteenth, and the *Sozura*, which form the fourteenth stage.

The former of these sub-classes comprises the *Proteus*, the *Siren*, and the *Siredon*, as among its best known representatives, while to the latter belong the Triton and the Salamander. These once abundant but now comparatively rare creatures have furnished naturalists with some of the most interesting examples of what may be almost called the *visible transmutation of species*. It is well known that frogs and toads (*Anura*), the more highly differentiated amphibians, instead of possessing both lungs and gills during life, as do the Dipneusta, undergo a complete metamorphosis after birth, passing from a true fish-form, in the tadpole state (in which, in addition to the well known external fish-like characters, they also possess gills and no lungs and a corresponding piscine circulation), to the familiar batrachian form in which their respiration is through lungs only and their circulation through two auricles. Now the two sub-classes above named furnish the most perfect and characteristic transition stages between the larval and adult states of the higher amphibians. The Sozobranchia, as the term implies, preserve their gills through life, but also acquire lungs, and are therefore strictly amphibious. They live, however, chiefly in the water, and there perform all the functions of their existence. The greatest excitement in scientific circles has been recently called forth by the extraordinary conduct of a member of this group. The Mexican Axolotl (*Siredon pisciforme*) was observed in the Paris *Jardin des Plantes*, where large numbers of these creatures were kept, to frequently take to the land, and several individuals so far habituated themselves to terrestrial life that they actually lost their gills in the manner of the higher amphibians. Individuals thus behaving were scarcely distinguishable from the *Amblystoma*, a genus of the Sozura which acquire lungs.

An equally remarkable phenomenon, but of exactly the opposite class, was manifested by the Triton, which belongs to the last named sub-class, and therefore habitually undergoes the metamorphosis common to frogs, etc., only without the loss of the tail. Before it arrives at maturity, the Triton, under ordinary circumstances, loses its gills and leads a sub-terrestrial life, breathing only air. But by placing it in a tank so shaped that it was unable to get out of the water, it was thus compelled to retain its gills through life, and even propagated in the water.

All animals above the amphibians are characterized by the possession, during their embryonic stages, of the important organ called the *amnion*, which is wanting in all below them, and in the amphibians themselves. The facts of ontogenesis as well as those of comparative anatomy justify the assumption of the former existence, probably in the beginning of the Mesozoic age, of a lizard-like animal whose fossil remains have not yet been discovered, and whose affinities with any known living form are not close, but which must have been the first to develop this particular organ, and was thus the progenitor of all that now possess it, and hence of man himself. This creature, which forms the fifteenth stage of man's genealogy, Haeckel calls the *Protamnion*. Out of it was developed primarily the great reptilian class, from which proceeded later the birds, with neither of which has man any direct connection. The origin of the mammals, however, must also be sought in the *Protamnion* stock, from which this class too must have proceeded, perhaps simultaneously with the reptilian branch, though in quite a different direction. The skull of all reptiles and birds is articulated to the atlas by means of a single condyle, while in mammals this condyle is double. From this circumstance the reptiles and birds have been designated by the common term *Monocondylae*. In them also the lower jaw is composed of several pieces, and movably joined with the skull by a special process, while in the mammals it consists only of a pair of pieces, and is immediately connected with the temporal bone. The further distinction between the scales and feathers of the former, and the hairs of the latter, is likewise an important one. The complete diaphragm of mammals, dividing the thoracic entirely from the abdominal viscera, and which is only partial in the *Monocondylae*, is a further very characteristic distinction. Finally, the existence of mammary

glands in the latter, from which the class takes its name, and which are wanting in all other creatures, not only indicates a very distinct position for the mammals, but combines with other characters to place them at the head of the animal series.

A very distinct race, which Haeckel styles the *Promammalia*, forming the next or sixteenth stage of man's descent, must have developed out of the *Protamnia*, and transmitted all these marked peculiarities to the entire mammalian class. Man himself possesses all these special mammalian characteristics, and is therefore a genuine mammal.

The nearest known living representatives of these hypothetical *Promammalia* are the curious and remarkable *Monotremata* of Australia and Tasmania. Of the entire sub-class only three forms are known, the singular *Orinthorhynchus paradoxus* and the *Echidna*, of which there are two species, *E. hystrix* and *E. setosa*. These animals seem at first sight to form an immediate connecting link between the birds and the mammals, as they possess the beak of the former with the lacteal glands of the latter. They further agree with the birds in having the anterior extremities of the clavicles united to the sternum, forming a sort of merrythought. A still more fundamental point of resemblance to the birds, and that from which the sub-class takes its name, is the possession of a common *cloaca*, the urino-genital duct opening within the body. The monotremes, however, agree with the mammals in all the characteristic attributes above enumerated, such as double occipital condyle, complete diaphragm, etc., while the cloaca, the merrythought, and other apparently avian characters, may have been inherited as well from the amphibians as from the birds. The beak, however, can only be accounted for as having developed independently from adaptation to conditions of existence similar to those which evolved the toothless jaws of turtles, from which it is believed the beak of birds has been derived. The beak of the *Echidna* differs from that of the *Ornithorhynchus*, and exhibits an approach towards the snout of the ant-eaters. The beaks of monotremes and of birds must therefore be regarded as simply analogous, and not as homologous organs.

The Promammalia no doubt differed in many respects from the Monotremata, and Haeckel is inclined to believe that they possessed regular teeth, which the latter lost through adaptive modification. At least the earliest fossil remains that paleontologists

have been able to refer with certainty to the mammals, and which occur in the triassic formation, consist of teeth only. From a few small molar teeth found in Germany, and also in England, the *Microlestes antiquus* has been constructed; and from similar dental remains found in this country, the *Dromatherium sylvestre* has been described.

Although the Monotremata differ from the *Monocondylae* (reptiles and birds) in so many important respects in which they agree with the higher mammals, they, nevertheless, also present many points of difference with these latter. In addition to those already mentioned (cloaca, united claviculae, etc.), the absence in these animals of any teats upon the mammary glands is very peculiar and anomalous. In consequence of this omission, the only way in which the young are able to obtain their nourishment, is by a process of licking against the porous breast of the mother; and Haeckel, therefore, proposes as a synonym for the ordinary name of the sub-class, that of *Amasta*, or mammals without teats. Again, the *allantoïs* is never transformed into a placenta, the *corpus callosum* is not developed, and there exists a pair of rudimentary marsupial bones. This last character affords almost conclusive proof of the descent of the marsupials from the monotremes.

The *Marsupialia* must therefore be regarded as the next group of animals in the regular line of descent which terminates in man, and as forming the seventeenth stage in the development of the human race. Here the cloaca is divided by a horizontal partition into two distinct orifices, both opening externally; nipples are formed on the *mammae*, to which the young attach themselves, and the clavicles are distinct from the sternum. In these respects, the marsupials agree with all the higher mammals. The distinguishing character in which they differ from them, and that from which the name of the sub-class has been taken, is the existence of a remarkable pouch or sack (*marsupium*) on the under side of the female, in which the young are placed at a very early period, and there retained until they are able to take care of themselves. This pouch has been aptly likened to a second or supplementary uterus, and the marsupials have accordingly been called by some, *Didelphia*. Our well known Opossum (*Didelphys*) is our only North American representative; but in Australia, this group of animals constitutes the greater part of the mammalian fauna.

The absence of a placenta is the only other important particular

in which the marsupials differ from the higher mammals. Indeed, the marsupium seems to constitute a sort of substitute for a placenta, and the want of the latter may be regarded as the physiological cause of the development of the former. The monotremes, however, are without either, and those who know would do well to explain how these animals are able to dispense with them both.

The so-called true *Mammalia* all possess a fully developed placenta, and are therefore distinguished from the two groups last mentioned as forming a third sub-class, the *Placentalia*. This organ is of great importance in the classification of the higher mammals, its mode of attachment furnishing excellent and reliable general characters. In some, for example, the placenta is deciduous from the inner wall of the uterus, while in others it is not, and on this distinction is based the primary division of the whole subclass into the *Deciduata* and the *Indecidua*. The latter are the least perfectly organized, and comprise the Edentata, the Cetacea, and the Ungulata. In man the placenta is deciduous, and he can therefore have descended from none of these.

The *Deciduata* again fall into two divisions according as the embryo is attached by the placenta to the uterus upon a single small area or disk, or by a band or girdle extending entirely around it. The former are called *Discoplacentalia*, the latter *Zonoplacentalia*. The *Zonoplacentalia* embrace the *Carnaria* (*Carnivora* and *Pinnipedia*) and the *Chelophora*, to which the elephant belongs. The *Discoplacentalia* comprise the rodents, the *Insectivora* (moles, etc.), and the *Chiroptera* (bats), the lemurs (*Prosimiae*), and the apes (*Simiae*). To this last legion also belongs man, who differs in this respect not at all from the mouse, mole, bat, lemur, or ape.

Now it is a remarkable fact that in one order of the marsupials, the *Pedimana*, embracing the two families *Chironectida* and *Didelphyida*, to the last of which our opossum belongs, the hind feet are modified in a peculiar way into organs for grasping resembling hands. This group can therefore only be regarded as exhibiting the earliest marks of that important course of transformation which culminated in the apes and in man. The course of development was from this group of marsupials directly to one within the *Deciduata*. Leaving all other animals wholly out of its course, the line of descent of man passes immediately from the *Marsupialia* to the *Prosimiae* or lemur group, an order which Haeckel takes out of Blumenbach's *Quadrumana*, because it is so much farther sep-

arated from the other apes than any of these are from one another. They are ape-like creatures, but shade off in a very interesting way into nearly all the remaining orders of the *Discoplacentalia*. The *Chiromys Madagascariensis* forms the transition to the rodents; the *Galeopithecus* of the Sunda Islands, to the bats; the *Macrotarsi*, to the insectivora; and the *Brachytarsi*, particularly the Lori (*Stenops*), to the true apes. They also exhibit close affinities to the Sloths (*Bradipoda*), which have been regarded as an order of the *Edentata* in the Indecidua; but recent investigations have proved that they have a deciduous placenta, and therefore it must be at this point that the Deciduata and the Indecidua join. The lemurs are harmless and melancholy nocturnal animals of a graceful form, and are chiefly confined to the islands south of Asia and east of Africa, and particularly to Madagascar. Their frequency on the islands of the Indian Ocean led the English naturalist Sclater to name this once continental but now mostly submerged region *Lemuria*, a circumstance to which Haeckel has given special prominence by pointing out the many facts which conspire to justify us in the conjecture that here may have existed the true "cradle of the human race." The lemurs form the eighteenth stage in the anthropogenetic line.

From the lemurs to the true apes the transition is comparatively easy. They evidently developed out of the *Brachytarsi*, the *Stenops* forming the nearest approach to a connecting link.

Linnaeus, with almost prophetic ken, notwithstanding his dualistic proclivities, classed man with the apes, lemurs, and bats, in his celebrated order, Primates. Blumenbach fancied he saw in the human foot a pretext for rescuing man from this association, and accordingly erected for him a separate order which he called *Bimana* (two-handed), distinguishing the apes, etc., as *Quadrumana* (four-handed.) This classification was adopted by Cuvier, and is the one which has generally prevailed among naturalists, down to Huxley and Haeckel. Huxley, however, gave the whole subject a complete re-investigation, and arrived at the conclusion that Blumenbach's order *Bimana* cannot be maintained on anatomical grounds. He shows in the most convincing manner that the distinctions alleged to exist between the posterior hands of apes and the feet of man are apparent only, that they were based on *physiological* and not on *morphological* considerations. The apes are just as good bimana as men are, and men are just as good

quadrumana as the apes. In neither are the posterior limbs in all respects homologous to the anterior. The tarsal bones are differently arranged from the carpal bones, and there are three distinct muscles serving to move the foot that are wholly wanting in the hand. But all this is as true of the apes as of man. The limited opposability of the great toe in man is only a functional distinction. The muscles of opposability are all present; they are merely atrophied by disuse and adaptation to altered conditions. Traces of this power are found in many savages who hold on with their toes to the branches of trees in the forests where they live, and otherwise employ this posterior thumb in a variety of ways which Europeans cannot imitate. There are moreover many instances on record of men acquiring extraordinary dexterity in the use of their toes. Every one in this country has seen the exhibitions of the armless man who traveled through our towns and displayed marvelous feats performed with his toes. Again, infants make far more use of their great toes than adults do. Watch a new-born babe as it lies in its cradle and amuses itself with exercise of its muscular activities; compare the movements of its hands with those of its feet, and you cannot but be struck with the comparative indifference with which it manages both. The human foot, whose careful study has been said to constitute a sure cure for atheism, and whose wonderful adaptation to the purpose to which it is applied has been regarded as an unanswerable argument for the doctrine of design, can therefore be nothing more than a natural result of the modification of the posterior hand of the ape, in simple obedience to the mechanical law of adaptation to changed conditions, while in it are found all the visible elements of that ancestral organ which the equally monistic law of heredity has transmitted from our simian progenitors. Huxley therefore restores the Linnæan order *Primates*, removing only the *Chiroptera*. Haeckel, however, would adhere to his order Prosimiae, the lemurs, for the reasons above stated.

The true apes are primarily divided into two great groups, which are as distinct geographically as they are anatomically. These are the *Catarhinae* or Old World apes, and the *Platyrhinae*, or New World monkeys. They differ chiefly in two important respects. The *Platyrhinae* have a flat and broad nose, like other animals. The nostrils open *outwardly*, and are separated by a broad interval. They have also 36 teeth, 18 in each jaw. In both these respects

they *differ* from man. The *Catarhinae*, on the other hand, have a somewhat projecting, laterally compressed, and often arched or acquiline nose, with the nostrils close together and opening *downwards*. They have only 32 teeth, or 16 in each jaw. In both these respects they *agree* with man. The clear-cut, much projecting, and elegantly formed nose of the Nose-ape (*Semnopithecus nasicus*) would adorn the face of any European nobleman, while the countenance taken in its *ensemble*, of *Cercopithecus petaurista* would be sure to call to any one's mind some not very bad-looking person of his own acquaintance. And yet these handsome apes are endowed with long tails. Not only is the number of the teeth of the *Catarhinae* the same as in man, but they are distributed in precisely the same manner, namely: 4 incisors, 2 canine or eye teeth, and 10 molars or grinders, in each jaw.

The *Catarhinae* are further divided into two groups of tail-bearing and tailless apes. The tail-bearing apes have most probably been developed directly from the lemurs, and therefore constitute the nineteenth stage in the descent of man. Our ancient forefathers in this group were perhaps similar to the now living *Semnopithecus*, from which the tailless apes, forming the twentieth stage, were differentiated chiefly by the loss of their tail. These latter bear the greatest resemblance to man, and are called anthropoid apes, constituting the family *Anthropoides*. This family consists, as far as known, of but four genera, *Hylobates*, the Gibbon of southern Asia; *Satyrus*, the Orang of Borneo and the Sunda Islands; *Engeco*, the Chimpanzee of southern and western Africa, and the Gorilla, first discovered by the missionary Wilson in 1847, on the Gaboon River, western Africa, and afterwards by Du Chaillu. The Gorilla is the largest of known apes, and exceeds the human stature.

To none of these four anthropoid apes, however, can we point as being in all respects the nearest to man. The Gibbon resembles man most in the form of the thorax, the Orang in the development of the brain, the Chimpanzee in the formation of the skull, and the Gorilla in the differentiation of hand and foot, and also in the relative length of the arms. It is therefore evident that man cannot have descended directly from any known living ape. His real progenitor must, in a greater or less degree, have combined all these characters, and has no doubt been long extinct. It is from paleontology that we alone hope for aid in the discovery of this "missing

ink." The fossil remains of this extinct genus (*Pithecanthropus*) lmay be looked for with some confidence in the still little known region of south-eastern Asia, the Malay Archipelago, and throughout central and western Africa.

The comparative anatomy and osteology of these four genera of anthropoid apes has been exhaustively studied by Carl Vogt, Huxley, and others. The final conclusion to which Huxley comes, and which he expresses in the most unqualified and emphatic manner, is that no matter what system of organs we take, a comparison of the modifications in the Catarhine series leads to one and the same result: that the anatomical differences that distinguish man from the Orang, Gorilla, or Chimpanzee, are not as great as those which distinguish these latter from the lower *Catarhinae*, (*Cynocephalus*, Makako, *Cercopithecus*.) Therefore, as Haeckel remarks, it is incorrect to say that man has descended from the apes; *he is himself an ape*, and belongs as strictly to the Catarhine group as the Gorilla or the Orang-outang! He therefore establishes another family within that group, together with the *Anthropoides*, which he calls the *Erecti* or *Anthropi*. This family he divides into two genera, the first embracing the now extinct ancestor of the human race, the *Pithecanthropus* or ape-man, which therefore forms the twenty-first genealogical stage, and the second being the genus Homo, or man as we find him, forming the twenty-second and last stage in his development from the moner.

Three anatomical distinctions of any importance are all that exist to separate the two families *Anthropoides* and *Anthropi*. One is the more erect posture of the latter—a difference of degree, however, which varies both with the apes and with men. The second is the higher brain development of the latter, which is also only a quantitative distinction. The third and only distinction which can be called qualitative, is the differentiation in the Anthropi of the larynx into an organ of speech. And not even this, much can be now fairly said, since it is found that the larynx of monkeys exhibits a much higher state of development than that of other animals.[3] Haeckel, however, regards *Pithecanthropus* as a speechless man, having the erect posture and differentiated brain, but who had not yet acquired the power of articulate language or the necessary organs for its utterance. For this reason

[3] Emile Blanchard, Voice in Man and Animals, in *Pop. Sci. Monthly*, Sept., 1876, page 519.

he offers also as a synonym for his name *Pithecanthropus*, the equally appropriate one, *Alalus*, the speechless. This, however, is only theory. In point of fact the erect posture, size and quality of brain, formation of vocal chords, and the origin of articulate speech, must have all advanced *pari passu*, mutually promoting one another, and developing by insensible degrees according to the universal method of all nature.

To the various races of men as recognized by ethnologists, Haeckel, in harmony with his general system, gives the rank of *species* of the genus Homo. All definitions of the term species having failed to unite upon any absolutely constant character as a condition to its application, the use of it here is justifiable, notwithstanding the ease with which the human races hybridize, and no matter what theory may be preferred of their origin or relationships. Of these species he makes out twelve, and advances an interesting theory of their origin and geographical distribution over the globe; but upon this new field we can here follow him no farther.

In casting a retrospective glance over the vast subject thus hastily passed in review, there are a few salient points which will have most probably in an especial manner struck the mind of the reader.

One of these is likely to be the great brevity of the anthropogenetic line, considering the variety and multiplicity of living forms found on the globe. We perceive that of the seven subkingdoms of animals now recognized, only three are touched by it, viz.: the Protozoa, Worms, and Vertebrates. The zoophytes, echinoderms, arthropods, and mollusks, all branch off either below or at the worm stage, and the transition from the *Tunicata*, a worm-form, is direct to the vertebrata. This, when adequately appreciated, is an astonishing fact, and one which would never have been conjectured but for positive anatomical evidences. Those who believed in a law of development were looking vainly for proof of the derivation of the different types one out of another, and discussing which should be considered lowest, the articulates or the mollusks. They expected to find proof of a series with the radiates at the bottom and the vertebrates at the top.

The truth, as it has at last dawned upon us, dispenses with all such speculations. Equally surprising is the shortness and directness of the transition from the lowest to the highest vertebrates,

from the Amphioxus to the Ape. All the vague surmises of some extensive course of descent and lineal relationship among the numerous classes and orders of vertebrates are also now brought to an end. The higher fishes and higher amphibians, the reptiles and the birds, are all left to pursue special routes of their own; and a brief series of easy and rapid transitions through the lowest fish-form, the *Selachia*, and the lowest amphibian-forms, the *Sozobranchia* and *Sozura*, brings us at once to the lowest mammalian stage. But perhaps the most surprising part of this whole course is its one great stride through the entire mammalian class, from the marsupial to the lemur. All the vain expectations of finding some thread of relationship that should lead through the labyrinth of varied mammalian orders, and connect us with the horse, the dog, the elephant, etc., are thus happily set at rest, and we are permitted only to claim such consanguineal relationship with the opossum, the lemur and the ape.

In fact, instead of a long concatenated "*chaine animale*," as Lamarck supposes, the animal kingdom presents rather a tree, spreading from very near the base with almost a whorl of unequal branches or subordinate trunks, each of which is again variously branched, giving the whole the form of an inverted cone or pyramid. At the upper extremity of each of these branches, which have come a long way independently of each other, is found one of the great groups or types of now living creatures, man occupying the highest summit of the vertebrate branch.

Contemplating now the great number of branches that arise at different points, some of which are short and apparently stunted, while others push upward with different degrees of vigor, only one or two reaching truly lofty and commanding positions, the thought forcibly strikes us that this picture reveals the universal tendency of nature to develop organic forms. We realize that this vital force or *nisus* is constantly pressing at every point, but that as the conditions of life are limited, success is possible only at a few points; that in consequence of obstacles of many kinds, not the least of which are offered by organic conditions themselves that have pre-occupied the field, the degree of success at these points varies widely, and produces all grades of vigor, size, length and ramification among the branches. The highest and most thrifty branches mark the line of absolutely least resistance; the shorter and less vigorous ones indicate lines offering varied degrees

of resistance; while the stunted, dwarfed, and retrograde branches show lines of resistance so great that the vital force barely overcomes it. Finally, all points from which no buds or branches arise teach us over how large a proportion of nature the resisting agencies wholly overbalance the organic tendencies, and no life can originate.

Another thought to which the attentive contemplation of this theme gives rise is the greater antecedent probability of like organs occurring in different animals being *homologous*, than of their being *analogous*. The conditions in which life finds itself placed are so infinitely variable that the chances are almost infinity to one against the development of the same organ independently at two different times and places. Where the same organ is unexpectedly found in two animals which had not been supposed to be at all related, it affords the strongest evidence that they are either immediately connected by blood, or at least that they have both descended from a common ancestor that possessed that organ. Hence the irresistible force of the testimony afforded by the so-called rudimentary organs, which none but those who realize this important law can properly appreciate. That analogues do sometimes occur in obedience to the law of adaptation cannot, however, be denied; but they usually betray their origin by being formed on an essentially different principle, though in such a manner as to accomplish the same purpose. The wings of birds, bats and insects are such cases of analogy, in each of which the morphological differentiation is wholly different, while the physiological function is the same. The beak of the Ornithorhynchus is perhaps as near an approach as we have to a true morphological analogue, the descent of that animal from the birds being overruled by a preponderance of evidence against it.

It is this principle, too, which conclusively negatives the presumption which some have advanced that the aborigines of America may have descended from the New World monkeys. Catarhine man could never have sprung from a Platyrhine ape.

It is moreover this same biological law which justifies Haeckel in the assumption of so many hypothetical and long extinct ancestral forms, although no warrant for them is afforded by paleontology. The Gastraea, the Chordonium, the Protamnion, the Promammalia and the Pithecanthropus are all creatures, not of his imagination, but of stern logic, based on a profound famil-

iarity with all the facts and principles that bear upon the problem. The common origin and blood relationship of all creatures that possess a spinal column, of all that are endowed with five-toed feet, of all that develop an amnion, of all that have the double occipital condyle, of all that suckle their young, of all having the fore and hind feet differentiated into hands, of all that have the catarhine nose and identical dentition—these are propositions whose demonstration, by the aid of the law of heredity, is as complete and absolute as that of any proposition in Euclid. There is no other way to account for these facts. The chances of these organs being so many independent morphological analogues, produced by adaptation to identical conditions, are but as one to infinity.

Either the dualistic conception of teleological design, *i. e.*, miracle, must be admitted, or else there is no alternative from this explanation.

LESTER F. WARD.

CAREY AND RICARDO IN EUROPE.

M. MAURICE BLOCK, in his review of foreign publications in the department of political economy, in the *Journal des Economistes*, of January last, mentions an attack made on Ricardo's theory of rent, which appears in a Berlin periodical, but is from the pen of Louis Felix of Vienna. M. Block says, "We are far from adopting all the opinions of Ricardo, but we are obliged to acknowledge that neither Mr. Carey, with all his talent, nor M. Louis Felix with all his science, has presented any valid objection to his theory .....When Mr. Carey says [*i. e.* objects] that population begins with the settlement of the mountains, where the soils are less fertile, he has not understood Ricardo. There is no need to take the word 'fertile' [as used by Ricardo] in a literal sense; he means simply 'advantageous'.....The theory of rent has become an engine of warfare; the socialists have seized upon that theory, and maintain that an individual should not profit by a lucky accident, that all the profit of accident should be covered into the Treasury of the State; but rent being represented as a spontaneous, gratuitous product of nature, the proprietor of the good lands ought to be taxed in such a manner that there shall be left to him no advant-

age from the difference in quality. It is in order to snatch their prey from the socialists that M. Louis Felix seeks arguments against Ricardo from every quarter, even from Liebig. Rent deserves neither such honor nor such indignity. If space permitted, we would show: (1) That it is pure envy which inspires these attacks upon the fortunate possessor of the rent of the soil, so far as it exists. (2) That it is not easy to assign its several share to [*a*] the capital employed; [*b*] the ability of the cultivator; [*c*] the fertility of the soil (the gratuitous gift of nature). (3) Rent ceases to exist as soon as the field, which has been favored by accident, is sold. The purchaser buys the property at its actual value; whatever be the fertility of the soil, it will not yield its owner more than the current rate of interest, the mean of profit from all possible soils. Lastly, we do not see why the owner of the soil should not profit even by its advantages, as well as an orator, a great singer, an able tailor, or any other sort of man or woman who happens to be born with a talent. As regards Mr. Carey, he, like another Monroe, lays down a special doctrine for America, out of the pure transatlantic patriotism, that is, which has no regard for Europeans."

Thus far M. Block. And now let us look at some of the concessions and some of the inaccuracies of this able and excellent writer.

First of all, let us note the new attitude of the orthodox political economy towards European socialism. Thirty or forty years ago, the Economists were regarded as the great bulwark against the destructive and subversive teachings of these wild theorists. They had shown, it was thought, the sufficient reasons for maintaining the existing edifice of society, in spite of all the misery and suffering which were found in seemingly inseparable connection with it. For the theory of population showed the natural and necessary origin of poverty and want; and did not the theory of rent do the same for the inequality of wealth? Or, as an American disciple of the school bluntly puts the case: "It is natural, and if natural proper, though we may not see the reason, that poverty, and want, and disease, and misery, should be the next-door neighbors of wealth and unbounded prosperity." All this seemed conclusive, until the socialists, instead of fighting their economical enemies front to front, outflanked them and began an attack on their rearward. We do not, at this writing, recollect of any one

before Frederick Lassalle who attempted this. The idea seems to have originated with that brilliant, but dissolute and unprincipled demagogue, or with his master, Karl Marx, who gave Europe a demonstration of Ledru Rollin's conclusions from Ricardo's premises. Since that day, the attitude of the European economic mind towards Ricardo's theory seems to have been undergoing a steady but gradual change. Some indeed stand by the old principles, in sublime indifference to any consequences which they have not themselves drawn. Some, like the *Katheder-socialisten*, seek to throw discredit upon the very method of the orthodox economists, and to establish a more inductive one in its stead. Others, like M. Block, are trying to modify the formulas of the school, so as to prevent their being of use to its enemies, and to bring them into a better harmony with observed facts.

M. Block would save Ricardo from Mr. Carey's criticisms by substituting the word "advantageous" for "fertile." Would Ricardo have accepted the new term? Would Ricardo's school of thirty years back have accepted it? Would his best scholars of our own times, Cairnes, Mill, or Fawcett, have accepted it? We fear not. They would have said that to substitute that term was to eviscerate the whole doctrine, and to convert it into a truism not worth enunciation. The forms in which they stated the doctrine would, many of them, become sheer absurdities after this substitution of M. Block's term for that of the master. Take for instance Mr. Mill's statement, that, "after a not very advanced stage in the progress of agriculture.....in any given stage of agricultural skill and knowledge.....every increase of produce is obtained by a more than proportional increase in the application of labor to the land." Now the premise of which this is the conclusion must be that the first settlers take the most *fertile* lands; and to make the alteration proposed by M. Block is merely to introduce a useless ambiguity. For if they take merely the most advantageous land, the land whose occupancy will produce the greatest benefit to themselves, it is quite possible that the lands most "advantageous" to cultivate, when the population is become denser, are left idle by those first comers. And if Mr. Carey's position as to the order uniformly pursued in the settlement of land, (a position sustained by a multitude of observed facts, and not directly questioned by M. Block,) be true, then as society advances in the power of numbers and of co-operation, the results secured by the occupation of new soils must be larger in proportion to the labor expended upon them.

Now if Mr. Ricardo is right, then land-holding is a part of the great system of *privilege* which existed throughout Europe some centuries ago, and which M. Block's country did so much to discredit and to overthrow. And the principle of equal rights cannot be allowed to prevail in some departments of society, and that of privilege in others. In the long run, one or other will prevail everywhere; and whatever cannot prove itself to be free from all complicity with the discredited and condemned principle, will share in its fate. This the logic of the situation; the socialists who appeal to Ricardo are simply Ricardoists, who have the courage of their opinions.

Now, when we look at M. Block's proposed answers to the socialists, we are struck by their exact analogy to those which were urged by the champions of the *Ancien Regime.* They may easily be translated into terms which will cover both cases. (1) "Your motive, gentlemen, is pure envy." Even so; if the envious man, the Marat or the Robespierre, have objective right on his side, the conscience of the race, which formulates itself in history, will accede to his plea, with no regard to motive. (2) "Privilege may be the starting-point of the monopoly, but the vested rights you assail have other bases. Admitted right and possession do largely coincide. All the grounds on which you concede that men should be allowed to exercise this function, are here united with those which you deny to be sufficient. No one can draw the line between the two elements, so as to do justice to the former and get rid of the latter." And the answer might be, as once before, that hardship must be inflicted, where society cannot endure the existing state of things. (3) "These vested rights you assail have in some cases been transferred from hand to hand by purchase. The new purchasers paid full market price for them. They have taken no unfair advantage." The case is precisely that of the owner of a slave, who should admit that there was injustice in his capture, but assert that there is none in keeping him in bondage. For if land is like political right, national property by natural right, and derives its value from nature, no number of private transfers can alienate it. (4) "These privileges and vested rights of ours, are like a fine voice or other gifts of nature to which a man is born." Modern science, by the doctrine of heredity, explodes this argument. It shows that labor and education are at the basis even of inherited gifts. And Mr. Carey cuts the whole tangled knot by his doc-

trine that land, like every other species of property, owes this quality, which you call value, this power to command a price or yield a rent, to the labor expended upon it.

At the conclusion of our quotation M. Block speaks of Mr. Carey's theory of land as a sort of Monroe doctrine, devised expressly for the transatlantic market. If we regard M. Block's meaning rather than the facts, we shall see this to be a singularly unhappy comparison, unhappy in the selection of both its members. The Monroe doctrine was not of American origin; it was suggested and inspired by Canning. It was not for the American, but for the European market; it was a warning to the Holy Alliance that they would not be allowed to deal with the Spanish Colonies as they had dealt with Spain. Its second great application was in that despatch to a European government, which has not yet been printed in its diplomatic correspondence, although it was obeyed to the letter,—the warning to the gentleman who for ten years played the part of patron to the English school of Economists in France, that his troops must leave Mexico.

Mr. Carey's doctrine of land and of its settlement is American only in the happy accident of its origin. We say "happy accident:" rarely has a great inductive student of social science been placed in a community in which the formative processes and all the successive stages of social development have been transacted before his very eyes. The instinct which drew Friedrich List to America to study society in the making, was a wise instinct. In Mr. Carey's surroundings it has found the fullest satisfaction; and these surroundings have left their impress upon his works. While European economists at their best give us no more than the *statics* of Social Science, derived from the study of the present of a society economically fixed and stable, Mr. Carey gives us the *dynamics* of that science. All his formulas and definitions are dynamical, notably so those of wealth, value, price, and money. Hence the insight and the sympathy with which he has scanned the economical history of every European nation. As Niebuhr found in the *marks* of his native Dittmarsh the clue which solved the riddles of Roman history, so has Mr. Carey found in the economic history of his native country the clues to that of Europe. To say this, is not to claim any special distinction for America; it is merely to say that, as a new country, she furnishes exemplifications of the laws of social growth, such as are not to be found in

older populations. An economist who has climbed the hillsides to talk with the founders and first settlers of great states, and has seen the Mississippi Valley occupied by the millions whose votes now control the destinies of the Republic, must have had very little use for his eyes, if he has not seen some things unknown to the London stock-broker, who devised the theory under discussion.

The particular thesis here in question, the law of settlement, Mr. Carey has confirmed by facts drawn from a study of the actual history of almost every country of the old world, as well as the new. He has shown the same law of *progress from worse to better, in land, in labor, and in food,* to underlie the social facts, wherever these facts are still within the reach of the student. He proved it true equally of the great historic movements of population, and of the history of the same farm in the hands of successive generations of occupants. Furthermore, his facts have never successfully been called in question, either singly or on the ground of their insufficiency as a basis of induction. And since he first announced them in *Past, Present, and Future* (1848), and again in *Principles of Social Science* (1858), they have received additional confirmation from historians and sociologists without number. So large has been this supplementary evidence that the present writer was able recently to go over the ground anew, and while drawing hardly anything from Mr. Carey's statements and his witnesses, to substantiate his results.[1] The only evidence we have seen alleged to the contrary, is that presented in a recent article in the London *Academy* by Mrs. Edith Simcox, who alleges the *Laws of Manu* as on the side of Ricardo. We very cordially concede to the Ricardoists all the weight which can attach to such testimony. The best orientalists have pronounced that famous code a fiction of the same class as the Apostolical Constitutions—an ideal code which never was, and never could have been in force in any age, or any country. And when we remember that this code was devised in the interest of a selfish aristocracy of priestly landlords, we may well avoid surprise in learning that it divides between landlord and tenant on the Ricardoan principle of giving the former a larger proportion of the product, the more fertile the soil.

To pass from romance to history, we find in the comparative prominence of different districts of France at different eras, sufficient evidence of the drift of population from the poorer to the

[1] See *Social Science and National Economy*, Philadelphia, 1876 (Pp, 98–128).

richer soils. Mr. Carey has called especial attention to the early importance of the mountain province of Limousin, which was at one time so strongly represented among the Roman Cardinals as to control the conclave. A writer in the *Fortnightly Review* of May last, writing therefore since M. Block, thus speaks of the district:

Arthur Young thought the Limousin the most beautiful part of France. Unhappily for the cultivator, these gracious conformations belonged to a harsh and churlish soil. For him the roll of the chalk and the massing of the granite would have been well exchanged for the fat loams of level Picardy. The soil of Limousin was declared by its inhabitants to be the most ungrateful in the whole kingdom, returning no more than four net for one of seed sown, while there was land in the vale of the Garonne that returned thirty-fold. The two conditions for raising tolerable crops were abundance of labor and abundance of manure. But misery drove the men away, and the stock were sold to pay the taxes. So the land lacked both the arms of the tiller, and the dressing whose generous chemistry would have transmitted the dull earth into fruitfulness and plenty.

Crossing the channel to the native land of this theory, we find Mr. Carey's account of the early settlement of England very fully confirmed by very recent authorities,[2] who give us notices more or less extensive of the movement of population in the early ages; and, although none of them holds the clue which explains these movements, they all confirm Mr. Carey's law of settlement. They tell us that the early Celtic occupants of Britain occupied merely the hill countries on the south and west of the Island of Britain; that traces of their presence on the island are to be found in none of those fertile plains which now are the pride of the island; that the possession of those bare hills was contested by the Irish from the west and the Saxons from the east, the former seizing on Northern Wales and the Western Highlands, about the time when the latter landed on the eastern shore, and founded the kingdoms of Wessex, Kent, &c. They tell us that even in Saxon times the population was found in districts where it was necessary to catch and save rain water, and that kingdoms in the hill country enjoyed a predominance which they afterwards lost, while the rich midland shires, now the pride of English agriculture, were a desolate,

[2] Mr. C. H. Pearson, in his *Historical Maps of England* (London, 1870); Mr. Llewellyn Jewett, in his *Grave Mounds and their Contents* (London, 1870); Mr. Thos. Hughes, in *Life of Alfred the Great* (London, 1871); Mr. John Hill Burton, in his *History of Scotland* (Edinburgh, 1873); and above all the Duke of Argyle, in his *Iona* (1871).

marshy and forest-grown wilderness, the terror of travelers and the peril of armies. They tell us that the great division between Northern and Southern England, which produced the separation of Scotland from the southern kingdom, and is still recorded in the ecclesiastical separation of the provinces of York and Canterbury, was due to the existence of that impassable region, which now smiles with the richest and best crops of the island. And they show that the whole history of the island has been "the progress from worse to better in land, labor and food."

The Duke of Argyle is a witness of special importance. His position at the head of the Cobden Club makes him, one may say, the official representative of the orthodox English economists; while the regard in which he is universally held as a man and a thinker, ensures attention to anything he says. Just about the time of his son's marriage to a daughter of the royal house, Mr. Robert Buchanan, the Scottish poet, published a work on the Highlands, which he obtained permission to dedicate to the Marchioness of Lorne. That permission should never have been asked. The book was little more than an attack upon the Marchioness's father-in-law on the ground that his conduct as a landlord had stripped the Highlands of their people, robbed the queen of many loyal subjects, and reduced the area of tillage while it extended that of sheep-farming. Many of the facts offered in evidence were misinterpreted by Mr. Buchanan, and it seems to be not without reference to this that the Duke writes in his *Iona*. He is speaking of the great Irish missionary, Columba or Columcille, (so well known to readers of Montalembert's *Monks of the West*,) who, from the little island of Iona, directed the great missionary work by which the Celtic people of the Highlands were Christianized.

"At a time," he says, "when artificial drainage was unknown, and in a rainy climate, the flats and hollows, which in the Highlands are now generally the most valuable portions of the land, were occupied by swamps and moss, on the steep slopes alone, which afforded natural drainage, was it possible to raise cereal crops. And this is one source of that curious error which strangers so often make in visiting the Highlands. They see marks of the plow high up upon the mountains, where the land is now very wisely abandoned to the pasturage of sheep or cattle; and, seeing this, they conclude that tillage has decreased, and they wail over the diminished industry of man. But when these high banks and

braes were cultivated, the richer levels below were the haunts of the otter, and the fishing places of the heron. Those ancient plow-marks are the sure indications of a rude and ignorant husbandry. In the eastern slopes of Iona, Columba and his companions found one tract of land which was as admirably suited for the growth of corn as the remainder of it was suited to the support of flocks and herds. On the northeastern side of the island, between the rocky pasturage and the shore, there is a long, natural declivity of arable soil, steep enough to be naturally dry, and protected by the hill from the western blast. And so here Columba's tent was pitched, and his Bible opened, and his banner raised for the conversion of the heathen."

Similar evidence we have of other countries of Europe[3] and Asia, but, like M. Block, lack the space. But we cannot omit one quotation from a Surgeon-General of the British army in Burmah. He is looking at the facts he records through the spectacles furnished him by Ricardo, but his testimony has its value:

In Burmah the land is superabundant, and where it has a saleable value, that value consists, not of the soil, but of the labor, skill, and capital which have been invested in its improvement. In the technical sense, signifying the difference in productive power between one kind of land and another, rent has no existence; for the best land is still abundant, and awaits only the investment of capital.

These are some of the facts which have weight with Mr. Carey and his school in leading them to maintain the great law of settlement, which he enunciated in 1848, and the related principle that the price of a piece of land represents, not the inherent and natural properties of the soil, but the labor and capital expended upon it. They deny that there is any essential difference between landed property and any other species of property,—or, as Lord Dufferin puts it, between a farm and a ship. Standing on this ground, they have confidence both for the present safety and the future prosperity of society. They are convinced that the Providence which orders the world will not suffer the overthrow of the institutions which have been built up by human toil and suffering, because false theories with the sanction of great names have been put in currency. And they are assured that the path of progress, heretofore trodden

[3] See Mommsen's *History of Rome* for Italy; Grote's *Greece;* Laveleye's *Economie rurale de Belgique*; Geijer's *History of Sweden;* Pauthier's *Chine;* Hunter's *Annals of Rural Bengal*, and Bunsen's *Egypt's Place in Universal History*.

by the feet of our race, is not to come to an end to-morrow or the day after. They still look for great advances, *from worse to better*, as in all other departments of the world's life, so *in land, labor and food.*

ROBT. ELLIS THOMPSON.

THE NEW DEPARTURE AT THE MEDICAL SCHOOL OF THE UNIVERSITY OF PENNSYLVANIA.

A LONG looked-for, much-debated change in the course and curriculum of the Medical Department of the University of Pennsylvania, has at last been made. Encouraged by the promise of sufficiently large money contributions, and relying upon the interest and support not only of the entire medical profession, but also of all intelligent and thoughtful persons, the Trustees, after much thoughtful and earnest deliberation and discussion, determined at a recent meeting to adopt the proposed changes and initiate a new order of things at the Medical School, to go into effect with the matriculating class of 1877–78. Much has been said and written, in this city, both explanatory and critical, within the past few weeks, concerning the various items of the reform. At the risk, however, of needless repetition, it has been deemed advisable to put into print a full and succinct statement of what has been done, with a brief survey of the ground covered by the movement. It will be well to consider the subject under four heads, viz.: What changes have been made, the reasons for them, their advantages to the medical student, and the objections critically considered.

I. Formerly attendance upon but two terms of five months each was required to prepare for a degree: the student could prolong his labors over a third term, but this was entirely voluntary. Henceforth three terms of five months each are to be obligatory. There was some talk of lengthening the terms to eight or nine months each, but upon further deliberation this was not thought advisable at present. Under the old system, the fees were $140 for each year, $5 for matriculation, $10 for the dissecting ticket, and $30 graduating fee. The fees were paid to the respective professors upon the issue of their course tickets. In future, the fees will be paid to the Secretary of the Faculty, who will issue a ticket

admitting to all the lectures. They will amount to $140 for the first and second years each, and $100 for the third year; the matriculating, graduating and dissecting fees to remain the same. The Medical Faculty will be composed, as during the past year, of eleven Professors of whom three will devote themselves exclusively to clinical teaching, though other members of the Faculty will also take part in this teaching, in addition to their didactic courses. Examinations will be conducted by a committee of seven selected from the whole Faculty. As the course of instruction will be carefully graded, the student will be examined at the end of the first year in General Chemistry, Materia Medica, and Pharmacy; at the end of the second year in Anatomy, Medical Chemistry, Physiology, General Pathology, and Morbid Anatomy: at the end of the third year in Therapeutics, Theory and Practice of Medicine, Surgery and Obstetrics. The studies of the three successive years will be classified accordingly. During the third year particular stress is to be laid upon clinical work at the bedside in the Hospital, in medicine, surgery, and diseases of women and children. Practical instruction will be given also in physical diagnosis, minor surgery and bandaging, ophthalmology, otology, dermatology, and electro therapeutics. In conducting these courses the class will be divided into sections of convenient size, so that each individual student may receive direct personal instruction. In addition to this, thirteen general and special clinics will be given each week, before the full classes. It will be seen at a glance that this curriculum is much more comprehensive and thorough than the previous one, and that five new branches, viz.: Pharmacy, Medical Chemistry, General Pathology, Morbid Anatomy, and Diseases of Women and Children, will be taught in future. In the first and second years, systematic laboratory training in the fundamental medical sciences will be given These changes will not affect any students who had matriculated before June 1st, 1877, unless at their expressed desire. The great importance of a preliminary examination was fully recognized, but it was not deemed practicable to establish it at present. It is however confidently expected that ere long it will be possible to add this important feature to the plan, as well as to increase the length of the courses to eight months. For the present it is thought that the yearly examinations will do all the weeding needful.

II. The *reasons* for this new step forward are evident. The high

reputation of all the European schools, from which the new system is borrowed, is an unquestioned guarantee of its educational value. And with the Harvard School at Boston on one side, and the Johns Hopkins University at Baltimore fast developing upon the other, Philadelphia, the birthplace of American Medicine,—and particularly the Medical Department of the University of Pennsylvania, founded in 1765, the earliest American School of Medicine,—can not afford to lag behind in the march of improvement. If circumstances were favorable and the moment propitious, it was right that the change should have been made: no one denies this proposition. So long as money to support it was wanting and plans were not thoroughly matured, it would have been abortive to attempt it, and ruinous to put it into effect; but sufficient moneys to fully meet all expenses, have been promised by certain liberal friends of the School, and will be forthcoming, while the plans just now put into practical shape have for a year, or more, been under consideration by a Board of twenty-four Trustees, who, as a body, are among the most thoughtful, conservative and far-seeing citizens of Philadelphia. The circumstances were favorable and the time was ripe for the change. The change was not lightly made, but upon much mature and grave consideration. Again, there is a strong argument to be drawn from the manifest defects and deficiencies of the old system. The average young American physician, fresh from his examinations, and with all "his blushing honors thick upon him," knows practically next to nothing of the vital part of his business, the diagnosis and treatment of disease. He may have all the knowledge of the schools and books at his fingers' ends; may know, perhaps, the names of all the articles of the Materia Medica, their source and application; but when he is brought to the bedside of a sick patient and asked to tell what is the matter and what the proper remedy, he is quite likely to be utterly and foolishly at sea. The senses of the doctor must be educated upon the living subject, and not upon the dead manikins of the text books. There is no science in the whole circle of knowledge where the theory and practice may be at times so much at variance—physiological actions and clinical facts. From all this it follows that the young city graduate, who has as a general thing more time and means at his disposal, never considers that he has put on the full armor of his calling until he has spent a couple of years as Resident Physician in some hospital. How his country brethren rise to skill and success it is hard to imagine:

probably their paths to fame are not unstrewn with corpses. The great desideratum of medical education in this country has been and is clinical experience; the average graduate has not any of it. If he goes straight into a practice upon graduation, he picks it up slowly as best he may, and stumbles over obstacles and mistakes to final experience. The bungling work of badly educated physicians is everywhere a matter of notoriety. This defect is to be remedied, as far as the University of Pennsylvania is concerned, by the change. The third year is to be largely devoted to clinical work in the hospital, so that the diploma of the School will hereafter certify that its possessor is experienced in the recognition and treatment of disease in all its insidious and deceptive forms. All this ground was gone over excellently well in an article on "Medical Education in the United States," by H. C. Wood, jr., M. D., in *Lippincott's Magazine* for December, 1875. It has only been by dint of pounding these stubborn facts into the people's heads and driving these nails of logic home, that the University has the opportunity to stand again where she stood twenty years ago—at the head of American medical colleges. Enough money has been made sure of to pay at least $3000 a year to each of the seven didactic chairs and $1000 per annum to the clinical professors, with sufficient surplus to meet the annual expenses. This means partial endowment; this puts the School pecuniarily beyond the question of success or failure, as dependent upon the number of its students. It is evident, however, that much larger endowment is desirable and even necessary, in order to enable still further advances to be made in the system of teaching, to found a larger number of free-scholarships for poor but highly deserving students, and to increase the salaries of the various Professors to a higher and more proper point. Medical schools, without endowment, it has been justly said, inevitably resolve themselves into money machines—you put in your penny and the wheels begin to move, but they move only a penny's-worth. Professors may be very high-minded, but you cannot expect them to teach medicine for a five-month additional, while their pockets are empty. Evidently this argument, strong as it may be elsewhere, will not henceforth apply to the University. The studies of the successive years are to be graded; there is a good reason why this should be so. Medicine is a progressive science; one must rise from facts to principles, from thought to action, from theory to practice. Chem-

istry, Materia Medica, Pharmacy, Physiology and Anatomy must be mastered before Surgery, Practice and Obstetrics or special branches are attempted. After examination in the primary branches they may be laid aside with propriety, for Anatomy lives again in Surgery, a good practitioner must be a good physiologist, and Therapeutics is but the application of Chemistry, Pharmacy and Materia Medica to the cure of disease.

III. The *advantages* of the new system to the medical student are many. The diploma of the University will in future be recognized as the guarantee of its owner's superior standing and experience, and will be more valuable to him accordingly. Formerly, $335 was paid for the two years' course, exclusive of charges for laboratory work, private courses in special branches, and private clinical instruction; $435 will be the total cost of the three years' course, inclusive of the best hospital work possible, with exhaustive didactic and clinical teaching in all the general and special branches. This will render the new three years' course in reality no more expensive than the old two years' course, while the clinical and practical advantages which the new system offers are far in advance of anything heretofore possible. So it will be an actual gain to pursue the longer and more arduous course, in view of its superior attractions. It is true that at some other schools a small proportion of the students voluntarily spend more time in medical studies than is required of them; but as there are no special facilities provided, they cannot employ this time to the best advantage, and are burdened with heavy additional expense for private instruction in practical branches. The absolute necessity of hospital residence as *interne* after graduation will be to a large extent done away with. Of course, such post-graduate instruction will always be desirable, if it can be had with convenience; but in future the University, like Harvard, will send forth her graduates fully equipped for immediate entrance upon the active duties of the profession: this will be a saving, not only of money, but also of time. The young University graduate will hereafter be able to make a living by his profession much sooner than before the change. He will outrun his less fortunate brothers, graduates from other schools, in the race for renown and fortune. The new system will cut short those interminable years of hard work and no pay, the horror and necessity of young doctors, the wilderness to their land of promise beyond. It will make phy-

sicians more scientific, hence more trustworthy. They will be recognized as men of complete preparation, and able to grapple at once more successfully with disease. It will give more time for study and cause less distraction and overwork. Only three or four examinations are in future to be passed every year, instead of seven at the end of the second year as formerly. The passage of the examinations on the fundamental branches at the end of the first and second years, will leave the mind free to devote all its energies to the mastery of new subjects during the third year, and better able thoroughly to understand the intricacies of Obstetrics, Therapeutics and Surgery. It will be more natural and easy—the passage from what is elementary and preparatory to what is practical, and of immediate importance in the profession. Lastly, the crowning advantages of the personal, bedside instruction in the hospital in the third year: the benefit of being able daily to witness disease treated by the most experienced authorities and with all the modern surgical and therapeutical appliances. The great clinical facilities available in the neighborhood of the University will enable the instruction given during the third year to be as complete and of as great value as can be found in any European capital. The conclusion is plain. There is nothing to repel and everything to invite the student to trial of the new plan.

IV. It only remains finally to consider whether there have been any objections urged to the new system of medical instruction, and how they are to be answered.

It is, of course, unnecessary even to allude to the various controversial publications which appeared last year. It is inevitable that when any large and complicated question, such as the reorganization of the Medical Department of the University, is under discussion, widely different views will be held by men equally well informed and equally desirous of promoting the best possible solution of the problem. Undoubtedly, however, one of the reasons which led to a longer continuance of such difference of opinion in the present case, was the difficulty of determining how strong and wide-spread was the support which was extended to the new movement. In fact, though owing its initiation to a few members of the medical profession, the Board of Trustees was from the first deeply interested in the subject, and devoted to every step of the movement that careful and deliberate consideration which its importance demanded. There is the best authority for

stating that these changes in the curriculum of the Medical Department represent the carefully matured convictions of the entire body as to the course which is demanded by the feelings of the community in regard to this extension of the term of medical education. In like manner the public utterances of many of the most influential members of the Faculty show clearly that they have long advocated such a change, but have hesitated to advise its immediate adoption because they were well aware that preliminary endowment was necessary. Now that this great desideratum has been supplied, at least to an extent which has satisfied the Board of Trustees that it is safe to adopt the much-needed improvements in medical teaching, there appears to be no longer any room for doubt that the new system is approved of by the vast majority of the profession. Indeed, in order to show how desirable a three years graded course of medical study is thought to be by all who are most immediately concerned, it is sufficient to call attention to the fact that provisions are made in almost every medical college in the land by which such a course may be taken by such students as may voluntarily elect it. Again, the American Association of Medical Colleges, at its recent meeting at Chicago, considered the question of a three years *obligatory* period of study at medical schools, and offered to vote in favor of such a plan if any one desired to press the motion. The Trustees of the University of Pennsylvania have therefore only carried into effect the reforms which so many other institutions have tacitly conceded to be desirable.

Some have said that such an elevation of the standard of medical education at Harvard, and at the University of Pennsylvania, and at a few other schools, will lead to the graduation of a limited number of physicians, educated above the average wants of the community, who will find it impossible to secure appreciation and esteem for the longer time and larger amount of money expended in obtaining diplomas. Such a view, however, is palpably a fallacy. In other branches of knowledge the American public has shown its full comprehension of the need of thorough and complete education, by the most generous support of institutions where the same system exists as in European countries. It is safe to say that it will be found that in regard to this most essential subject of medical education, the general intelligence of the people has already led them to condemn the present hasty and superficial

method of teaching, and that they will heartily indorse and support those schools which, like the University, are courageous enough to take this important step of advancing their standard of education.

It has been objected that, although it was possible to Harvard, standing comparatively isolated and without close competition in New England, to carry such reforms into successful effect, yet that the different results which must follow such a course at the University, will be to break down her classes and to increase correspondingly the number of students in attendance at the Jefferson Medical College and at the New York Schools.

The facts and reasons that seem to indicate that any such reduction in the classes at the University will be to a far less degree and for a much shorter period of time than has been feared, have been briefly stated. But even if the falling off be more serious than it promises to be, the University could well afford to leave the larger classes and greater profits to other schools, and to rest proudly content with the reputation of providing the community with a class of physicians of far higher attainments and greater practical ability than can possibly be furnished by the old plan of teaching. It is the confident belief of all those interested that the action of Harvard, followed as it has been by the University of Pennsylvania, will soon compel all medical schools which aspire to occupy the front rank in the estimation of the public to make similar reforms in their system of teaching; or if they do not, to find their *prestige* gradually slipping away from them. M.

NEW BOOKS.

THE CHILDHOOD OF THE ENGLISH NATION, or the Beginning of English History. By Ella S. Armitage. Pp. xii., 247. 12mo. New York: G. P. Putnam's Sons.

The new school of English historians has its weaknesses and its prejudices, but it has made English history readable and credible. Freeman, Green, Stubbs and their associates are not infallible; we could even break a lance with them as to Roman elements in English history and civilization; but our indebtedness to them is past estimate.

Mrs. Armitage's little book belongs essentially to their school, though she does wickedly and profanely speak of "the Anglo-

Saxon Chronicle," and allege Wright and Pearson among her authorities, and is perhaps hardly aware of the antagonism of views which she traverses. She makes a womanly slip here and there, as when she ignores the part played by Scotch and Irish missionaries in Christianizing England; but she writes good English with vivacity and accuracy, and tells the story of the nation down to Richard the First's time, in a very intelligible and readable way. In one point she far surpasses her masters. She writes on religious topics with more insight and far less superficially than do Green and Freeman, reminding us in this respect of Mr. Pearson's *Early and Middle Ages.*

LITERATURE PRIMERS—PHILOLOGY. By John Peile, M. A. 12mo., pp. 164. New York: D. Appleton and Company. 1877.

To compress a treatise on philology within the limits of less than two hundred duodecimo pages, making it measurably complete and yet sufficiently elementary to be labeled a "primer," requires a good deal of ingenuity as well as a thorough mastery of the subject. The author of this little work has, however, shown himself equal to the task, and has written a book which, containing but "little Latin and less Greek," and as free as possible from technical phraseology, will give the readers for whom this series is designed a very good idea of what philology is and what it has accomplished. At the outset the reader is led "in medias res," with a long chapter on "The Constant Change in Language"—change in the form, meaning, and pronunciation of words—illustrated by well chosen examples from the English, and he is half way through the book before he fairly becomes aware that he is doing more than learning curious facts in the history of his own tongue. The remainder of the volume covers a broader field, and here the novice in the study of languages will, we apprehend, find much that is dry reading, and much that is so rapidly passed over as to be quite unintelligible. The author has attempted, in fact, to give too much information, particularly in the chapters which treat of "How Languages Have Been Formed," "How Words were Made," and "The Beginning of Syntax." A smaller number of points illustrated and explained more fully, to the exclusion of a host of less striking points, would have imparted more real knowledge. There are these defects, but as a whole the book is excellent both in design and in execution, and will add materially to the value of this neat series of "primers."

HAMLET. Edited by Horace Howard Furness. 2 vols. J. B. Lippincott & Co. 1877. Philadelphia.

The last anniversary of Shakespeare's birthday was suitably commemorated by the publication in this city of the Variorum Edition of Hamlet, by Horace Howard Furness. It is the third play of the series, following Romeo and Juliet, published in 1871, and Mac-

beth, in 1873, and it is uniform with them. With the usual mechanical excellence, characteristic of the publishers, each volume is in itself complete, giving the reader a perfect digest of all the wealth of literary research expended on the play; and if the services of the editor be spared to complete a similar edition of all the plays, it will remain unequalled as a monument of persistent and successful labor. Over a hundred years have elapsed since the first Variorum, that is, an edition giving all the readings of the text of Shakespeare, as found in the various early copies of his plays, and it is more than half a century since Malone published the Variorum which has been the standard up to this time. Furness' is, however, the first to give every reading and all the suggestions and comments of any authority, and at the same time to furnish an abstract of all the historical and philological learning that has been so freely expended in illustrating Shakespeare. It keeps pace with the progress that has been made in Shakespeare literature, in the study of the sources whence the poet and dramatist drew his inspiration, in the knowledge of contemporary learning of his time, in the philological analysis of his language; it brings us up abreast with all that wealth of literary activity devoted to the study of Shakespeare, such as has not been expended on any purely secular book, only the Bible has produced a literature of its own greater than that which owes its existence to Shakespeare. Mr. Furness has devoted himself to gathering, from all quarters, the vast amount of material thus provided, and he has exhausted it in the preparation of his Variorum Edition, giving in brief the gist of all his study. Few men have been able to bring together, from all the ends of the earth, the immense amount of material that has been published, in the pious effort to illustrate and elucidate Shakespeare. Although the largest proportion of books on the subject, in all its diversities of method and treatment, are those in the English language, the contributions of Shakespeare scholars in German are of capital importance, and a knowledge of their books is necessary for any intelligent discussion of the subject. It has been a task of infinite labor thus to accumulate the mass of books treating of Shakespeare, and Mr. Furness has gathered a Shakespeare library which counts within its numbers every edition of the plays, and every book written about them and about the author, which can in any way add to and elucidate the original text.

Messrs. J. B. Lippincott & Co. have lent the valuable help of the large resources of their great publishing house, to make this Variorum Edition a standard that will serve at least as long as did its predecessor. Macbeth, and Romeo and Juliet, were published each in a single stout volume, and now Hamlet has appeared in two goodly octavo volumes; and formidable as this may appear at first, it must be borne in mind that in them we find the best results of many hundred volumes specially devoted to this one play. Mr.

Furness has carefully abstained from setting up any theories of his own as controverting those of other Shakespeare commentators, devoting himself sedulously to the task of adding to the text of the edition received as of most authority, every suggestion from the early editions, from the later copies, and from the newest sources, that could help the student to ascertain all that has been said about Shakespeare's Hamlet. The historical apparatus, as the Germans are fond of calling it, that is, the collection of all the sources from which Shakespeare could have drawn for his use consciously or unconsciously, has been industriously made and studied by Mr. Furness, and now in his Variorum Edition are brought together all that Shakespeare himself could have read or heard on the subject that he has made his own and immortalized by his Hamlet. The steadiness of purpose with which Mr. Furness has worked in gathering his material, is not more commendable than the uniform modesty with which he subordinates his own views, and adheres rigidly to his plan of supplying the substance of what others have said.

As a rule, Shakespeare commentators have allowed their subject to run away with them, and few editions of Shakespeare, and still fewer discussions on his plays, or his language, or his plots, or his life, are free from theories and vagaries that may well startle the reader and make him wonder whether studying Shakespeare is not of itself a sort of madness not unlike Hamlet's,—hard to tell where it is real and where feigned. Mr. Furness, however, has shown himself a consummate master of the most difficult of all arts, that of knowing when to speak and when to be silent. With an intense love of his subject, he has illustrated it by all that could be gathered from every authoritative source; and that no matter what the language or the purpose of the author, so that it seemed to inform the reader as to the true meaning, the right place and the possible purpose of any word, phrase, verse, or part of Shakespeare's own writing. Even in the dangerous and seductive field of suggested readings and emendations, Mr. Furness has bravely withstood the temptation of offering solutions of his own, while he has carefully given every help that could be of use to the most exacting student. In this way he has given to the public an edition that is in the highest degree creditable to his modesty, his perseverance, his scholarship, and his learning. It is a very great satisfaction to find that he has known so well where to get help from those nearest at hand, and he makes grateful acknowledgement to his associates of the Shakespeare Society of Philadelphia, and especially to the late Professor George Allen, whose knowledge of Shakespeare was like all his attainments, profound and of practical value. The service rendered to the public by the labors of a little knot of men devoting themselves to the thorough study of Shakespeare, is rarely appreciated or appreciable, and their work has its best and often its only reward in the self-improvement that comes of diligent

work. But the debt due to Mr. Furness for his long and laborious task in preparing his Variorum edition, is one that calls for instant acknowledgment from all who love Shakespeare, and from that still larger number of those who are grateful for the devotion of years of laborious study, more for the benefit and instruction of the public than for any personal glory or gratification. Of course, without an intense admiration of Shakespeare, and the help and encouragement of those immediately about him, Mr. Furness could never have carried on his work to its successful results; and if to the influences that have thus borne such rich reward, be added the encouragement of knowing that those for whom this work has been done really appreciate it, we may yet see a complete Variorum Edition of Shakespeare, furnished by the same hand that has contributed the volumes that so nobly open up the series. The largest meed of praise has come to Mr. Furness from abroad, but both in England and in this country there is a general expression of surprise that any single individual could gather together the library necessary for his task, or could alone study its contents and make so exhaustive and successful a contribution to the Shakespeare literature of the time. While the infinite credit and honor all belongs to Mr. Furness, the excellence of his work has redounded to the benefit of Philadelphia, while the whole country shares in the distinction of his Variorum as the best edition of all.

BOOKS RECEIVED.

Turkey. By James Baker, M. A. 8vo. Pp. xii.; 495. Cloth, $4.00. New York: Henry Holt & Co. [Porter & Coates.

The Washington-Crawford Letters, being The Correspondence between George Washington and William Crawford, from 1767 to 1781, concerning Western Lands. Chronologically arranged and carefully annotated, by C. W. Butterfield. 8vo. Pp. xi.; 107. Cloth, Gilt top, $1.50. Cincinnati: Robert Clarke & Co.

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